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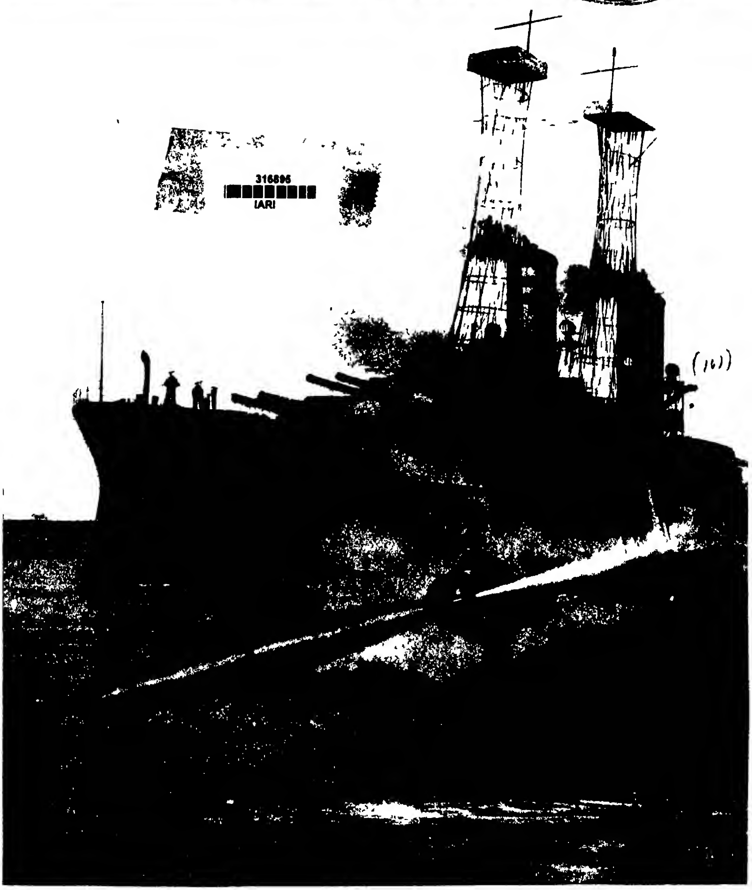

The air exhaust from the torpedo is clearly visible, passing astern from the after end of the torpedo.—[See page 8.]

A WHITEHEAD TORPEDO JUST AFTER ITS DISCHARGE FROM AN ABOVE WATER TUBE

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles *short* and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement.

Retrospect of the Year 1912

Civil Engineering

In a review of civil engineering works of the past year the progress of the Isthmian Canal at Panama naturally receives the first attention, and it is sufficient to say that during the year this stupendous task has moved toward its approaching conclusion with that uninterrupted regularity which has marked the work as carried on under Col. Goethals. Not even the enormous slides in the Culebra cut, the bulging of the slopes at Gatun Dam due to the hydraulic action of the semi-liquid core of the dam, or the threatened settlement of the guide walls at the locks have dismayed the working force for a moment. Each crisis has been met and mastered, and to-day everything promises fair for the sending of the first ship through the canal (in an experimental way) in the autumn of the present year and the official opening on January 1st, 1915, not only of a completed canal, but of a canal whose mechanical and human operating forces are in thorough working order. Next to the Panama Canal in the magnitude of the total excavation is the Ambrose Channel, 40 feet deep and 2,000 feet wide, extending for nearly seven miles from deep water into New York Harbor. Not many people understand that this great work, which has been done so unostentatiously, has involved the excavation of nearly seventy million cubic yards of material, or just one third of the amount that will have been taken out when the Panama Canal is completed. The canal is 98 per cent dug and the early months of the present year will see the task completed. The Ambrose Channel will form another monument to the efficiency of that able professional body, the Engineer Corps of the United States Army. The year has seen steady work done upon yet another great engineering task, that of damming the Mississippi River at Keokuk, Iowa, where a dam about a mile in length is being constructed, and a hydraulic electric plant with a first installation of some 200,000 horse-power will serve to transform the energy of the impounded water into light and power. The power house will be extended from time to time as the commercial demand increases. Great progress has been made on the New York State Barge Canal, which will make it possible for thousand-ton barges to navigate between the Great Lakes and New York city. Practically the whole of this great work of reconstruction is under way, much of it is completed, and the opening of the canal is promised by the year 1915. Another important waterway, the Welland Canal, a Canadian competitor of the State Barge Canal, is to be greatly enlarged at an estimated cost of $45,000,000. The improvement will extend from Port Colborne to a short distance north of Thorold. The depth will be increased from 14 to 25 feet and 30 feet in the locks, and it will be widened from 150 to 200 feet. The locks will be reduced from 22 to 7, and eight hours' time will be saved between Port Colborne and Port Dalhousie. Such good work has been done on the Cape Cod Canal that its completion and opening are promised during the next winter or, at the latest, in the early spring of 1914. This waterway will provide a 25-foot depth from Barnstable Bay to the 30-foot depth in Buzzard's Bay, a distance of 12¼ miles. The work of providing an additional daily water supply of 500,000,000 gallons for New York, known as the Catskill Water Supply, has made great advancement during the past year. The Ashokan Dam is practically completed, the huge siphon, passing 1,100 feet below the Hudson River, is concreted, much of the aqueduct, which is from 12 to 17 feet in diameter, is also completed, the shafts for the deep-water tunnel below New York are driven and in some cases the headings of the tunnel have been broken through, and it is promised that this year water from the Catskills will be turned into the Croton Reservoir, thereby removing any immediate danger of a water famine in this city. Mention should be made of the work that has been done in completing the Los Angeles Aqueduct, through which water will be supplied to that city from a point in the Sierra Mountains, 240 miles distant. The work will include forty-seven miles of tunnel and nine and one third miles of inverted steel siphons, some of which are ten feet in diameter.

Electrical Engineering

Although no single achievement stands out very prominently in the field of electrical engineering for the year 1912, nevertheless there has been general activity and a steady, healthy growth in all lines of electrical work. This has been marked by a determined effort to promote the electric vehicle for pleasure and for commercial service and to promote the introduction of electricity on the farm. One enterprising New England company has introduced the very novel idea of having a traveling electrical exhibition. The show is given in a circus tent which is set up in various agricultural communities in the neighborhood of the central station plant, and farmers and suburbanites are given an opportunity of seeing for themselves the advantages of electrical apparatus on their farms and in their own homes. One of the most important electrical undertakings has already been mentioned in the previous paragraph, because in its construction it is of particular interest to the civil engineer. We refer to the Keokuk Dam across the Mississippi River, which will provide hydro-electric power of something like 1,000,000 horse-power. In California, the power of the water flowing through the Los Angeles Aqueduct is to be fully utilized. Seven hydro-electric plants are being constructed and it is estimated that they will generate 118,000 horse-power. According to the report of the Commissioner of Corporations, 6,000,000 horse-power is now developed in this country by water and several million more could possibly be developed from the same source. Abroad there have been some very important water power developments, particularly in Norway. There preparations are under way to develop 500,000 horse-power in addition to the existing 430,000 horse-power. This doubling of the amount of current generated is due to the demand of electro-technical industries. There has been some activity in the electrification of steam railroads. Locally, the most important item for the year is the work of the New Haven Railroad in extending its electrified zone from Stamford to New Haven. The new equipment will be practically identical with that on the existing electric road, indicating that the company is evidently satisfied with the efficiency of its present electrical installation. The most interesting railroad work abroad has been the completion of a Jungfrau railroad, which provides access to the summit of that lofty peak. In Mexico an electric railroad has been proposed to run to the summit of Mt. Popocatepetl, not for the purpose of carrying passengers, but to permit of transporting sulphur from the mine in the crater. Ten enormous electric locomotives are being built for the Swiss railways. They will weigh 108 tons each and will be the most powerful single unit electric locomotives so far, being capable of developing 2,500 horse-power at a speed of fifty miles per hour. Each can exert a draw bar pull of 40,000 pounds. The use of the storage battery for traction purposes is increasing. Recently a storage battery train was built and shipped to Cuba for use on the Havana Railroad. Storage battery cars are meeting with continued favor in New York city, and the storage battery locomotive is being used very extensively in the aqueduct tunnels and the new subway work. The most prominent event in the field of wireless telegraphy has been the completion of the Naval Station at Arlington with its 600 foot antennae. In Germany, at Nauen, a tower 970 feet high is being erected, which is expected to have a radius of 6,000 miles. In France a system of wireless telegraphy without sparks has been developed, giving wave-lengths about ten times greater than has heretofore been possible with a given antenna of the sheet type. Following the loss of the "Titanic" in April, radical measures were taken to provide for constant attendance upon the wireless telegraph apparatus on board ship. In addition to this, there have been important regulations to control the amateur wireless telegraph operator. No amateur is now allowed to operate a transmitting instrument of power sufficient to reach beyond the borders of his State, without obtaining a license from the Government. Transatlantic wireless telegraphy is now conducted on a reliable commercial basis. Before dropping the subject of wireless telegraphy we must refer to experiments with the wireless control of torpedoes in which some material progress has been made during the year. Some progress has been made in long distance telephony. England is now able to talk directly with Switzerland. This long distance communication is of course made possible by the use of Pupin coils in the lines. In this country the telephone is being increasingly used for train dispatching. Experiments with the telegraphic transmission of photographs are still being carried on abroad, although little if anything has been done in this country as yet. The electric steel furnace is steadily making its way into the steel plant. We have recently learned that an all-electric steel melting plant is being built in Sheffield, England, the home of the steel industry. At the Panama Canal electricity is to be used very extensively for light and power purposes. The towing engine at the locks will be driven by electricity, and the lock gates will also be operated by electric motors. To furnish the power necessary for this purpose, a hydro-electric plant is being built which will obtain its power from Gatun Lake. Altogether there will be about 7,000 lamps at the locks and 1,000 individual motors.

Naval and Military.

Conditions in the Navy during the past year have been eminently satisfactory, with the one important exception that Congress saw fit to cut down the annual appropriation for battleships just one half, authorizing the construction of only one such vessel this year. A striking evidence of the efficiency and preparedness of the Navy was afforded by the great review at New York last autumn, when, at short notice, a fleet of 123 ships, aggregating 720,480 tons was gathered in the North River. In 1912 there were 168 ships in active service or ready for service as against twenty on the repair list—certainly an excellent showing. The quality of our ships is excellent, but in number they are too few. When all ships built, building or authorized are taken into account, we find ourselves dropping quickly behind the other leading powers, for in dreadnoughts, it is shown that England has 80 ships, Germany, 23, and the United States, 13 only. On the same basis, the relative order of tonnage is Great Britain, 2,478,152 tons, Germany 1,124,267 tons, and the United States, 808,485 tons. Congress should authorize at least three dreadnoughts this year to repair last year's deficiency. Oil fuel has proved such a success that it will probably be used exclusively in future warships. The oil burning destroyers are able to run at all speeds with perfectly clean smokestacks, and the new battleships, "Nevada" and "Oklahoma," of 27,500 tons displacement, will be fired exclusively with oil. Apart from the important feature of invisibility, due to the absence of smoke, there are other advantages of the reduction in the number of smokestacks, the abolition of bunkers, the oil being carried in the double bottom, and a great reduction in the operating staff. The mechanical reduction gear on the "Neptune" has proved to be satisfactory—eminently so, and new turbines, more suitable to the conditions, are being built, which are expected, in connection with the gear, to show the many advantages of economy and convenience of operation which have been predicted, both in the motive power and the control of the ship. The "Jupiter," which is to have electric reduction gear, will probably undergo her trials in the near future, and it is confidently believed that the theoretical advantages of this type will be fully demonstrated. During the year foreign powers have continued to build battleship-cruisers which combine a battery of the heaviest guns with fair armored protection and extraordinary speed. The "Moltke" and "Goeben" of the German navy are credited with trial speeds of 29 to 30 knots, and the British "Lion," carrying eight 13.5 guns, has made an average of 33 knots in six trials on the measured mile. We should build at least one experimental ship of this type. The destroyer continues to prove its efficiency and general serviceableness, and the leading powers are agreed that at least four of these ships should be built to each battleship. The submarine increases in size, speed and offensive power. It is proving so successful that some authorities consider that it may dominate the warfare of the future. The coast fortifications of the United States are practically completed, and work has been pushed actively on the fortifications of the Philippines and the Panama Canal. The new army 14-inch gun gave every satisfaction in its earlier trials at the proving grounds. One wirewound and two hooped guns of this type have passed successfully through their trials. The fourth gun, when fired with its maximum charge, exploded, the breech and outer hoop being torn apart. This matter is now under investigation, and our ordnance officers believe that the defect is one that can be fully remedied in future guns. The disappearing mount is favored for coast fortifications, but some turret mountings are being built for the defenses at Manila.

The Merchant Marine.

In any review of the past year in matters affecting the Merchant Marine, the tragic loss of the "Titanic" naturally receives first consideration. Next to the pitiful loss of some 1,500 people, the most disquieting feature

of the tragedy was the fact that the ship was the latest and largest of the great ocean liners, and that she came from one of the finest shipbuilding yards in the world. It is now well understood that her loss was due to the fact that she was insufficiently sub-divided. The test was of course a supreme one, nevertheless she should have been so well protected as to stay afloat, even under that terrible ordeal. The disaster drew attention to the fact that shipbuilders have not lived up to the high standards of under-water protection set by Brunel, when he built the "Great Eastern" over half a century ago. That the White Star Company, at least, learned this lesson, is shown by the fact that her sister ship, the "Olympic," is now at the Belfast yards, where she is being provided with a double skin throughout the greater part of her length, and her subdivision is being greatly amplified. Similar changes are being made in the "Britannic," which is now under construction. Both the Senate inquiry in this country and that under Lord Mersey in Great Britain emphasized the necessity, not merely of providing life-boats for everyone on board, but of so thoroughly subdividing a ship that a repetition of the "Titanic" disaster will be rendered impossible.

Great as are the ocean steamships of the present day, their dimensions still continue to increase. Next spring, the "Imperator," 919 feet in length, will be dispatched by the Hamburg American Line to this port, and about the same time the Cunard Company will send over on her maiden voyage a ship of approximately the same size, something over 900 feet in length, which will be an enlarged "Mauretania" with somewhat less speed. The past year has seen an active revival of the burning question of providing longer piers to accommodate these ships at the port of New York, and a bill has been introduced into the House favoring the straightening of the pierhead lines from the Battery to Pier 80, which will provide accommodations for twenty piers from 950 to 1,040 feet in length. The oil engine continues its invasion of the field of marine transportation, which for so long has been held exclusively by the steam engine. The successes of the past year have been truly phenomenal. Two large freight steamers, the "Selandia" and the "Christian X" have proved successful even beyond expectations. These are sister ships. The "Christian X" made her maiden voyage across the Atlantic last September. She is 370 feet long, has a displacement of 10,300 tons, and is driven by twin Diesel engines of a combined maximum indicated horse-power of 2,500. She steamed, on her maiden voyage from Hamburg to Havana, 4,027 miles at a speed of 11 1 knots, with a consumption of only 0.34 pounds of oil per hour. Engines of even larger size are under construction, and it now seems certain that within the next few years oil motors will be applied to ocean ships of the very largest size.

Steam Railroads.

On steam railroads, at least in the United States, there is a growth in the size and weight of the individual unit, corresponding to the increase which we have noted under the head of Merchant Marine among the ocean steamships. Both for freight and passenger service the modern engines have attained proportions undreamed of only a few years ago. The Pennsylvania Railroad Company has recently completed a passenger engine for its heavy, fast, mountain service, with a total boiler heating surface of no less than 6,000 square feet. It is not so many years ago that 3,000 square feet of surface was considered extraordinary. A gratifying fact is the steady growth in the number and popularity of all-steel passenger cars. The Pennsylvania Railroad set a good example by building no more passenger cars of wood, and before long the whole of its service will be of steel construction. Other railroads are following suit. The steel car is one of the greatest protections to human lives and limbs in the event of derailment or collision. But with this increase in the weight of rolling stock comes the realization of the fact that the track is not equal to its work. Not only must rails be made heavier, but—and this is far more important—they must be made of a much higher grade of steel. The rail breakages of the past few months have increased in number and have proved frightfully disastrous. The remedy is to be found chiefly in a more careful casting of the ingots, taking all the time that is necessary to secure sound metal, and in the introduction of one or other of the successful methods of ingot casting, notably that of Hadfield, which have been developed abroad. This, with more careful work in the rolling mills, will make it possible to turn out a steel rail that will not be a cause of continual, heart-breaking anxiety to those who build and operate our railroads. Given perfectly sound and reliable rails, creosoted ties, tieplates of ample surface on every tie, and the replacement of the inefficient spike by the screw spike, and we shall have tracks over which our trains may be run at the highest speed with perfect safety. These changes, coupled with that "general stiffening of discipline," of which the railroad management have so much to say in these days, will go far to reduce our present appalling annual totals of killed and injured.

Astronomy

The most spectacular event of the year was the discovery on March 13th of a nova or new star by Enebo, an assiduous Norwegian observer of variable stars. When first seen it was a little above the fourth magnitude, but by March 16th it had sunk almost to the fifth. The spectrum of the new star presented the typical appearance of many novæ—broad bright and dark bands widely displaced, with this exception: Prof. Kuestner of Bonn found dark lines of uranium and radium emanation in the spectrum. The importance of that discovery can hardly be over-estimated, since it may help to shed some light on the moot question of the origin of novæ in general. One of the most important astronomical events was the recapture—if we may so speak—of a very remarkable asteroid on October 3rd, 1911, by Prof. Palisa of Vienna. All the asteroids move eastward, around the sun, but the eastward motion of all previously known planets (except Eros at perihelion) is slower than that of the earth, so that we leave them behind and they seem to move toward the west. The news of the discovery was spread abroad by telegraph, and on the following night another observation was secured by Palisa, and two by Techule at Copenhagen. Bad weather set in, the moon came along and made the sky too bright to see faint stars, and, after she had gone, the new planet was lost and could not be recovered. Mr. Haynes of the University of California, using certain very powerful methods of calculation, developed by Prof. Leuschner of that university, succeeded in getting an approximate orbit, which was published last April. Thanks to Haynes, the planet has been identified on a plate taken at Heidelberg in the middle of September and one exposed at Johannesburg on October 18th.

Dr. Slipher, the able assistant of Dr. Percival Lowell at Flagstaff, for the first time obtained evidence concerning the rotation of the planet Uranus. Spectroscopic observations show this to be a little over fifteen hours, the direction of motion being retrograde. A comet visible to the naked eye was discovered by Gale of Sydney, Australia, on the morning of September 9th. Its orbit proved to be nearly if not quite, parabolic in form and was remarkable chiefly for the fact that its plane was almost at right angles to that of the ecliptic. Its closest approach to the sun occurred on October 5th at a distance of 67,000,000 miles. A second comet was discovered by Schaumasse at Nice on October 18th. As soon as its orbit was roughly computed, it was seen that it was moving in a path very similar to that of a well known periodic comet—Tuttle's—which last appeared in 1899. But, according to the orbit then computed, this comet is not due to return until January, 1914. Fayet, a colleague of the discoverer of the comet on its present return, made a preliminary calculation of the motion of Tuttle's comet since 1899 and found that toward the end of 1900 it passed within 70,000,000 miles of Jupiter, whose attraction considerably modified its period, and accelerated its return by three months. The comet is of interest on account of its period—thirteen and a half years—intermediate between the numerous groups with periods varying from five to seven years and the longer periods, like that of Halley's comet, and also because of the high inclination of its orbit to the plane—fifty four and a half degrees. A third comet was discovered by Borrelly at Marseilles on November 2nd. An eclipse of the sun occurred on April 17th. The distance of the sun and moon happened to be in just such a ratio that the two bodies, as viewed from certain parts of the earth's surface appeared of exactly the same size.

There was a total eclipse of the sun on October 10th, visible in a small part of the southeastern United States as a partial eclipse just after sunrise. The trail of total obscuration began in the Pacific off the coast of Nicaragua crossed South America from one point in Ecuador, a little north of Quito, to one in Brazil a little south and west of Rio de Janeiro, after which the whole course was lost in the South Atlantic. The greatest observable duration of totality was about one minute and sixty seconds on the Brazilian Coast.

Miscellaneous Science

While there has been every sign of activity and successful advance in all branches of pure and applied science during the past year, we have no one particularly striking discovery to record. The field of molecular physics continues in its rapid development, to which especially Sir J. J. Thomson and Prof. Perrin have contributed so important a share. Special mention must be made, in this connection, of the recent work of Dr. Laue at Munich on the molecular structure of crystals, as revealed by Röntgen rays, another experimental substantiation, along a wholly new line, of the atomic theory.

In the domain of chemistry it appeared at one time as if the year 1912 might bring the realization of the commercial production of synthetic rubber. But it appears that we must have patience for yet a while before this important step is fully accomplished. The Eighth International Congress of Applied Chemistry brought a wealth of interesting material to light, yet there is no one particular paper which, for its historic significance, calls for special mention in this retrospect.

In biology perhaps the most remarkable work in hand is that for which the Nobel prize has been awarded to Dr. Carrell—on the survival of excised animal organs, and the growth of such tissues in vitro.

Science shows no signs of lagging, there has been a steady advance along the entire front, though perhaps we have only few achievements of fundamental novelty to record for 1912.

Obituary

The obituary of the year in so far as it relates to Science and Mechanics, contains such notable names as those of Lister, Melville, Rotch, Wilbur Wright, and Poincaré. To mention the name of Joseph Lister is to think of the untold blessings of antiseptic surgery, for he was undoubtedly the father of that most merciful art. Before Lister's day the mortality from major operations varied from 50 to 61 per cent, to-day it seldom exceeds 10 per cent. He was graduated in 1852 and from 1869 to 1877 he held the chair of Clinical Surgery in the University of Edinboro. Long before this incumbency, however, he had done much experimental work to prevent germinal infection of wounds. He used carbolic acid as a germicide and his first application of antisepsis was made in the treatment of compound fractures. To him we owe the practice of dressing wounds with lint, soaked in carbolic acid, and it was he who first covered wounds not with cotton, but with sterilized gauze. But for Lister's work the marvelous surgical operations of the present day would be absolutely impossible. In the death of Abbot Lawrence Rotch the scientific world lost its foremost amateur meteorologist. Rotch was a pioneer in atmospheric exploration, in company with Assman and deBort. Being possessed of an ample fortune and a cosmopolitan education, he elected to lead a life both scholarly and useful. He founded in 1885 his Blue Hill Observatory, where he developed the technique of the meteorological kite, which has been called the corner-stone of the twentieth century science of aerology or the exploration of the upper air. This observatory has formed a model for all others including that instituted by our own Government. The successful use of automatically recording instruments at Blue Hill so impressed General Hazen, the chief signal officer, that they were officially adopted and have been in use in Government stations throughout the country. Mr. Rotch conducted the first American researches with sounding balloons, and he was the first in this country to use the pilot balloon to determine wind velocity and direction aloft by means trigonometrical observations. Nowhere is the value of his work more fully appreciated than in the field of aeronautics, where its practical results will become increasingly manifest as the years go by. The death of Henri Poincaré meant the passing of a great mathematician and philosopher, who by many competent authorities was considered to have been the greatest mathematician of our day. In his literary work, and particularly in his three books, the "Value of Science," "Science and Hypothesis," and "Science and Method," there is to be found that clearness and charm of style which are so frequently found combined in the deepest thinkers of the scientific world. His greatest work was done in the application of mathematics to physics. In the death of Rear Admiral George W. Melville, the Navy lost one of its most distinguished officers. He is probably most widely known for his heroic efforts to save the remnants of the De Long party in the arctic regions, and this was followed up by able scientific work done in connection with his later arctic expeditions. As chief engineer of the United States Navy, he was successful in maintaining American marine engine practice abreast of that of the world. In the death of Wilbur Wright, America lost one of its most distinguished and successful inventors. At a time when the world at large and indeed the majority of the engineers and scientists who wished to solve the riddle of flight, were thoroughly discouraged and ready to believe that a successful man-carrying flying machine was inherently impossible, Wilbur Wright, in company with his brother, Orville, determined to gather up the many broken and separated threads of the investigation, piece them together and carry it on if possible to a practical solution. All the world knows how by making a short, half mile flight in a motor propelled man carrying machine they at last succeeded. The announcement of their success met with the usual incredulity. They returned to their little workshop, and in a few years time forced conviction upon an unwilling and astonished world. The universal high regard in which Wilbur Wright was held was due as much to his modesty and absolute sincerity as to the brilliant achievements which stand to his credit.

[The review of aviation and aeronautics will appear in our next issue.—EDITOR.]

A Parcels Post Tunnel Railway

Transporting Mail Automatically by a New System

[The advent of the Parcels Post will probably create a demand for means of transporting large numbers of parcels by some more expeditious and less easily interrupted method than the horse drawn vehicles or motor cars that must be relied upon for the present at least The following article describes one system which has been constructed for demonstration purposes —EDITOR.]

Placing a parcel in the car The space is sufficient to hold six ordinary mail sacks, or many Parcels Post articles.

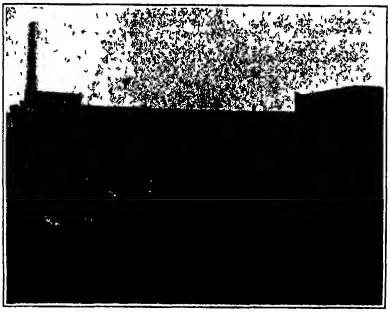
As the car stops the shoes are unlocked, and the car may be moved out of the way of the following one.

IN five of our big cities, namely New York Chicago Philadelphia Boston and St Louis, a large part of the first-class mail is transported between the post office and branch stations and railway stations through underground pneumatic tubes. These tubes are 8 inches in diameter and the letters tied up in small bundles, are dispatched in steel carriers which fit like a piston in the tube, and follow one another in rapid succession There are some routes—for example between railway stations, or between general post offices and railway stations where it is desirable to transmit the mail in sacks or pouches that are too large to be sent through the pneumatic tubes A commission has recently been appointed by the Postmaster General to investigate the feasibility and practicability of an underground tube or tunnel between the new post office located at the Pennsylvania Railroad Station, and the Grand Central Depot, in New York city which will be large enough to transport the mail in sacks.

An automatic tunnel railway has been designed that can be laid either underground or on the surface in which small cars are propelled by electric motors mounted on them, in much the same manner as ordinary trolley cars, but with this difference, that there is no attendant on the car to control it A demonstration plant of this new system has recently been erected on a vacant lot in Cambridge, Mass. opposite the site of the new Technology buildings by the company that operates the pneumatic mail tubes

It consists of a galvanized iron building 60 feet long for a station, a tunnel and track nearly a third of a mile in length that begins and ends in the building, and a car to run on the track Inside the station are located an electric generator controlling switches, instruments used in making experiments, space for loading and unloading cars, and means of switching the cars from the main track

The tunnel railway car is cylindrical in form, about 25 inches in diameter and 7 feet 3 inches long, large enough to hold an adult There is one supporting wheel and two guide wheels at each end.



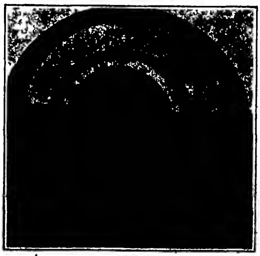
A demonstration plant of the new automatic railway tunnel system. It comprises a tunnel and track nearly one third of a mile long and begins and ends in the station in the background. Car in position on the track.

to sidings. Leading out of the building is a tunnel made of 30-inch diameter cast iron pipe, similar to ordinary water pipe. Four rails are laid inside of the pipe, one on the bottom to support the car, one on each side to keep it in an upright position and on insulated conductor rail on the top This pipe or tunnel is 234 feet in length and includes a bend of 90 degrees. The track extends beyond the pipe in a skeleton tunnel formed of cast iron hoops at intervals of three feet, to which the rails are attached. This skeleton construction is used for the rest of the distance around a rectangular space, terminating in the station Part of the way it is supported on trestle work to make an ascending and descending grade of 5 per cent. The total length of the track is 1,534 feet and includes four curves of 50 feet radius. No shorter curves or steeper grades would be required in underground lines for regular service At one point a short section of concrete tunnel has been constructed of elliptical cross-section 6 feet high and 7 feet wide to show how two tracks can be laid in a single tunnel In some places a single concrete tunnel is preferable to two cast iron pipes, and it has the further advantage of giving freer access to the tracks.

The car which runs through the tunnel on the 3 rail track is shown in the accompanying photographs. It is cylindrical in form about 25 inches in diameter and 7 feet 3 inches long The space for mail and parcels inside the car is 24 inches in diameter and 4 feet long sufficient for six ordinary mail sacks, and if used for parcels post would be ample for a large number of miscellaneous parcels. The opening through which the car is loaded and unloaded is closed by a double-hinged cover that can be opened from either side. There are one supporting wheel and two guide wheels at each end of the car The supporting wheels have double flanges, and one of them is connected through

(Concluded on page 18)

An automatic tunnel railway that can be laid underground or on the surface, in which cars are propelled by electric motors, in much the same way as ordinary trolley cars, but with this difference, that there is no attendant on the car to control it.



Four tracks are laid on the inside of the railway, one at bottom to support the car, one on each side to keep it upright, and a conductor rail on top.

Scientific Management for Scientists

"The Bridge." The Trust Idea Applied to Intellectual Production

By Professor Wilhelm Ostwald

[*WILHELM OSTWALD must be reckoned among the founders of the modern science of physical chemistry. As the director of the Physico-chemical Institute of the University of Leipzig he not only himself contributed a lion share toward the upbuilding of this science, but by personal encouragement, teaching and writing, he has done more than is probably realized by all but a few to assist in the making of such men as Arrhenius, Bredig and others. It will be remembered, too, that one of van't Hoff's principal publications appeared in an early issue of the Zeitschrift für physikalische Chemie, then newly founded by Ostwald. Of late years, since laying aside his professional duties Ostwald has devoted his main efforts to philosophical work and to the support and propaganda of movements relating to various phases of scientific and public activities.*—EDITOR.]

Within the last century or so the world has awakened to a realization of the fact that, of all the social activities of humanity, science in its broadest sense, is the most important. It is true that as yet the appreciation of this state of affairs has failed to find adequate expression in a practical way, and the so-called civilized nations are to-day spending incomparably more for the maintenance of barbarous military organizations than for the scientific development of problems relating to the culture of mankind, although the former are specifically destructive of energy and pernicious in their action, while only the latter work for energy concentration and upbuilding. The leading spirits of all nations, however, have long since come to a clear understanding of this situation, and accordingly we see numerous institutions, universities, academies, scientific societies, etc. engaged in energetic and effectual activity in the effort of extending the entire field of human knowledge to the utmost.

The phase of this field which has not as yet been satisfactorily organized is essentially that which relates to the character of the knowledge after which we are to strive. Through a perfectly natural process of historical evolution many still regard a mere knowledge of the past, a mere accumulation of facts, as real science, and only slowly, under the pressure of the exigencies of our day, the fact is gaining recognition that all science has one and but one purpose, viz., that of *predicting the future.* Hence every branch of knowledge which claims the right of cultivation by humanity at large, or by an individual nation, must, first of all, justify its existence and prove its claim to social support by demonstrating its social value—which consists in nothing more nor less than its capacity of forecasting the future, and thus influencing it in a direction favorable for humanity at large.

Thus, for example, as has been clearly shown in the development of medicine in the last few decades, it is now merely a matter of time, and especially of money, whether and to what extent great afflictions of the people, such as tuberculosis, can be exterminated, and humanity thus be freed from one of its direst plagues. The successful war waged against a number of febrile diseases by an investigation of their mode of propagation through the agency of mosquitoes has resulted in the opening up of great tracts of territory on our earth, which were hitherto uninhabitable owing to the prevalence of such diseases, and has thus greatly increased the total population which can find sustenance and be accommodated with some degree of comfort upon our globe. At an expenditure of a few millions of dollars it would be possible to solve in exactly the same manner greater and more difficult problems, and, I repeat it, it depends merely on our spirit of enterprise how soon and how successfully such work will be actually realized.

While the financial means for carrying out work which obviously and directly serves for the welfare of the community are obtainable with comparative ease more difficulty is experienced when the effort is made to engage assistance for some abstract scientific work, which can be applied only in the third or fourth instance to the direct amelioration of human conditions. But such science also deserves the most assiduous and careful attention. The question whether a given knowledge can or cannot serve for forecasting the future, need not be restricted to the inquiry whether such prophecy relates to possibilities of direct practical application. Every anticipation of the future may sooner or later become important. A very good example of this is the development of organic chemistry which originated in Germany in the hands of Liebig primarily as a matter of purely scientific research and which has since then made Germany the unquestioned peer in the world's chemical industry.

PROFESSOR WILHELM OSTWALD

We can therefore say—speaking very generally—that at the present day a great deal is being done for science. Indeed, at times it almost appears as if too much were being done, for, if we inquire from any worker in one of the large divisions of science about the present state of our knowledge in such field, the answer is almost invariably a complaint that it has become practically impossible for the individual to follow the total production in his science, which has grown to gigantic proportions. While in the first half of the last century one head, such as Berzelius, was capable of completely commanding the entire field of chemistry, so that he was in a position for many years to write his famous "Annual Report" (Jahresbericht) on the advances of chemistry, and to give an authoritative statement of the value of the researches covered, such an undertaking, comprising the whole province of chemistry, is, at the present day quite unthinkable for a single individual. Even the subdivisions, as organic chemistry or physiological chemistry have grown so vast, that there is probably no man living at the present day who can command such a division in the same way as years ago Berzelius covered the entire field.

What has been said of chemistry is equally true of the numerous other branches of science. Everywhere complaints are made by workers and investigators that it is becoming more and more difficult to obtain a complete survey even in a comparatively restricted field of the current scientific production of the day.

The conclusion in brief is that *at present the scientific production exceeds the human capacity for assimilating it.* The ratio which the production of new knowledge bears to our means of disseminating and utilizing the same has become modified to the detriment of the latter task. This is a perfectly natural phenomenon for the production of knowledge is a matter of such primary importance that it has received very predominant attention on the part of the most enlightened uplifters of humanity. It is only in our own day that the second problem has become more and more pressing in view of the conditions depicted above. It is true that in certain of the smaller subdivisions of human knowledge an inner technical organization for the purpose of effecting the assimilation in question has taken place. In particular to chemistry the debt is due on the part of the rest of the scientific world for the invention of the Annual Review by Berzelius, through which the total production of a year is brought together in orderly sequence and arranged in handy form for future reference. But this method of recapitulation is no longer sufficient with modern high speed of production and thus, for instance in the *Chemisches Zentralblatt* of the German Chemical Society we see an attempt to communicate to the world at large the current production with the minimum loss of time possible. Such abstracting is very widely developed in the field of chemistry and in other sciences also. The great chemical societies of all civilized nations have each organized a separate abstracting service which seeks to cover comprehensively the total scientific production of the world in the form of short abstracts.

It will be easily seen that this method is attended with great waste of energy. Not only are there three independent abstracting centers among English speaking nations—one controlled by the American Chemical Society, another by the English Chemical Society and a third in a certain measure by the Society of Chemical Industry—but in addition to these there are at least five or six abstracting agencies in the German language devoted partly to the entire field of chemistry and partly to large subdivisions thereof, in addition to these there are similar publications of the same character in French, Italian, Russian, etc. Every paper published is therefore abstracted independently at least ten times and in this way an immense waste of energy is incurred which is in no way inherent in the matter at issue but is purely the result of lack of organization.

What I have stated here from personal knowledge with regard to the lack of organization in chemical science, is seen again in precisely the same way in the other sciences. A few domains in which co-operation is particularly important, such as astronomy and meteorology, are considerably better organized in proportion to their special needs. These organizations are international, but are restricted to certain narrow fields of pure and applied science. Other international organizations, which theoretically cover the whole field of science, such as the Association of Academies, have not

yet acquired a form of activity which should insure for them co-operation with economy of energy in the entire field of science, so that here also the problem still remains to be solved

Now it so happens that at the present time, in an entirely different field, namely, that of finance, a process is going on which may be regarded as a model for the organization of science and intellectual work The recognition of the fact that competitive struggle is the most energy-destroying and impracticable of all methods by which opposing wills can be brought into equilibrium, is gaining a stronger and stronger foothold. In place of bitter competitive strife among related industries and commercial undertakings, we see going on everywhere the inverse process of the combination of analogous enterprises for joint collaboration and for the rational distribution of the several functions to such parts as are, through the general force of circumstances, best adapted to perform the same, or in other words, as are in a condition to carry them out with the highest efficiency in energy consumption

The process which we thus see going on in the world of economics must necessarily unfold itself also in that field in which the highest possessions of humanity are treated, namely, the field of intellectual labor The need has become urgent that the total work of this activity of the human race be so organized and brought into harmonious union that no energy be wasted Energy *is* wasted where one and the same piece of work is performed several times over, as we know is the case, for example, in the abstracting of current chemical literature, and energy is also wasted where each individual piece of work is not performed under the most favorable conditions with the best auxiliaries available at the present time. An organization of the world's intellectual work would therefore have to solve the problem of exerting a favorable influence in these two directions.

If, now we ask ourselves how such an organization could shape its activity, the answer is as follows The *highest* creative productions in science will have to be left as before to individual highly gifted heads and all that an organization can do here consists in placing the mechanical aids for such work at the disposal of those who are capable of carrying it out. In this direction a great deal has already been done, as was remarked above, both by private initiative and by governments Work of this character, then, cannot very well be organized At the other extreme, on the contrary, there is every possibility of organization The possibility of thus organizing that is to say, of establishing some uniform and simple plan, is given pre-eminently in the case of those portions of intellectual work which are simplest and most widely distributed, for the simpler a matter is, the more easily can it be made independent of the individuality of each worker and the more readily can it be replaced by, as it were, factory methods of production and a mechanical mode of procedure. With this point in view, then, an international institute was founded last year in Munich, under the name "Die Brücke" ("The Bridge") * which deliberately and positively follows the plan of undertaking the organization of scientific work, not from above downward, as hitherto, but from below upward, by, first of all, introducing uniformity and effecting a saving of energy consumption in those things which can be thus rendered uniform without prejudice to the main task itself Such are more particularly matters of detail relating to the technique of the production and use of publications and books. By far the greater part of science is, at the present day, recorded in the form of paper covered with writing or print, and consequently a practical and thoroughly efficient "*get up*" of this fundamental tool of all intellectual work represents a problem of fundamental importance

Thus, the establishment of a definite scientific scale of size for books and publications of every kind, has, for example, been one of the first tasks undertaken by "Die Brücke" If we reflect how very much easier all labor of writing and printing would be if it were carried out uniformly upon paper in a series of systematically well regulated sizes, how much less space would be taken up by books in our libraries if they all had the same height and breadth, how much easier the management and indexing of all collections of printed documents would be, had we not continually to contend with the differences in the sizes of the volumes, it will be seen that this seemingly trivial matter, in point of fact, lies at the base of all rational organization of scientific work.

The work of "Die Brücke" is not to be restricted to this. Part and parcel of this purely technical organization, which comprises, in addition to the work mentioned, a number of similar tasks, such as the preparation of copies, the cultivation of international language, etc is also the organization of the intellectual work already accomplished and of that still in progress, as regards its arrangement according to subject, author and institution. "Die Brücke" is planned as a central station, where any question which may be raised with respect to any field of intellectual work whatever finds either direct answer or else indirect, in the sense that the inquirer is advised as to the place where he can obtain sufficient information. Just like a telephone central, "Die Brücke" is intended to place every investigator in communication with every one of his fellow workers and to unite his field of work with every other field, and in this manner ultimately to establish a central for the entire unlimited field of intellectual work, by making use of which every person can automatically find his place in the great organism of the entire intellectual world, working with the minimum waste of energy

Within the last few years successful efforts have been made in America to introduce the idea of scientific management in all sorts of fields, so that we may expect with confidence to find there a responsive audience when we speak of the organization and systematization of the world's intellectual work. "Die Brücke" has only recently come into existence and is therefore still engaged with preliminary work in Germany, the place of its origin, but we believe that we can confidently assert that our first brother institution, which will work together with "Die Brücke," according to the same principles and with the same aims, will be opened in the United States, the energetic and determined population of which seems best adapted, not only to perceive the unlimited utility of this plan of organization, but also to secure for it a practical realization.

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The Military Supremacy of the Air—II

By Theodore M R. von Keler

(Concluded from the SCIENTIFIC AMERICAN, December 28th, 1912, page 550)

WHILE France possessed a goodly number of airships of the Lebaudy and Clément Bayard type several years ago, the rapid development of the swift aeroplane placed the large airship in the background, and it was not until the Zeppelin successes that France awoke to the fact that it had allowed Germany not only to catch up in this particular field, but to set the pace for other nations to follow The need for large ships capable of staying in the air twelve hours or more at heights above 4,500 feet, and of traveling 500 to 600 kilometers without landing, was felt, and the new law provides for several new ships of not less than 8,000 cubic meters (282,516 cubic feet) During the year 1913, more ships are to be constructed, until the readily available aerial battleship fleet comprises twenty first-class up-to-date ships. Thereafter this number of ships is always to be kept ready for service, old types are to be constantly improved or displaced by new ones, similar to the programme followed in naval affairs.

In the report of Clément to the French Senate on the subject of airship construction, special emphasis is laid on the excellence of the rigid type The separate compartment idea is also advocated, as utilized in the Zeppelins, while the armament and observation platform of the Zeppelin ships are recommended for use on the new French ships now building.

It is but natural that such extensive plans for increases in the size and number of the ships should demand similar plans for the housing, transportation and filling of these giant aircraft The big fortresses, Verdun, Toul, Epinal and Belfort are fully equipped as aerial "harbors," while Maubeuge, Reims, Chalons-sur Marne, Chalais-Meudon and La Motte-Breuil are being prepared for the reception of airships.

The great maneuvers of last fall have shown that aeroplanes, in order to be of real value to an army, must be capable of rising from the ground anywhere without the necessity of depending on a permanent base. The first requirement is naturally a ready means of taking the machines apart for transportation, this was one of the tests of army aeroplanes last year, and has been made more rigid this year It is now required that aeroplanes can be taken from the motor truck, put together and made ready for flight in the space of ten minutes. Specially designed motor cars accompany the aviation companies, carrying spare parts, supplies, wireless outfits and even complete machines in "knock-down" condition.

In order to be absolutely independent of road conditions in a hostile country, some of the aviation companies will be attached to cavalry and artillery divisions, and the horses of the latter will be utilized in pulling the aeroplanes cross-country, where it is desired to save fuel and keep the presence of the machines hidden from the enemy

What type of flying machine is most suited to military work, is still a much mooted question The rapid development of the various types renders a final selection impossible at the present time, but two or three-seated machines are preferred to singles. The ministry, quite sensibly, contends that the handling of the aeroplane itself is at present such a difficult and comparatively complicated matter, that no opportunity is left to the aviator to take proper heed of the ground below him, to make sketches or notes, or to receive and send wireless messages. To take care of the most important duties of the military aviator, an observer should take a seat in the machine, whose sole occupation would be the reconnoitering of the enemy's position and an examination of the territory over which the machine flies. For this work only the older, more experienced officers of the general staff are to be used, leaving the youthful lieutenants in charge of the flying.

An aeronautic section of the French army consists of eight aeroplanes and fourteen motor cars, divided into four columns. The first column has two monoplanes with single seats, for fast superficial observation and delivery of orders, the second has two biplanes with double seats, the third has aeroplanes with two and three seats, while the fourth, or reserve section has one single and one double-seated machine. Each section comprises seven pilots and fifty non-commissioned officers and men.

Besides these "regular" aeronautic sections there are a number of especially fast and powerful machines, capable of carrying two observers each in addition to the pilots, for emergency work. These machines are directly under the orders of the commanding general, are kept near his headquarters, and are able to cover a territory of not less than 100 miles radius.

At the beginning of this year France could mobilize thirteen sections with over 200 available aeroplanes, while before the end of this year no less than 334 machines (30 triples, 160 doubles and 144 singles), valued at $1,000,000, operated by 286 military pilots and 210 observation officers, will be in use. The average life of an aeroplane is fixed at two years and the operating cost $000 annually for each machine.

During the great artillery maneuvers in March of this year, aeroplanes were used in determining the firing efficiency of the guns. Six Blériot single-seated monoplanes, four Farman double-seated biplanes, and three triple-seated Bréguet machines were used in the tests with remarkable effect. While the officers are naturally reticent about the exact results obtained, it has been positively stated that any hostile battery could be destroyed in a few minutes by means of the aeroplane observations, provided it was located within shooting distance Particularly the aeroplanes with two and three seats did good service, and monoplanes with single seats are not likely to be used in this work.

France pays special attention at present to inventions designed to throw or drop explosives from soaring aeroplanes on moving trains, on bridges, powder magazines, etc It is, of course, self-evident that the first hostile step on the part of Germany would immediately be followed by a descent of a flock of French aeroplanes upon frontier towns and fortresses. Bridges would be destroyed, railroad tracks demolished and magazines exploded, thereby greatly hampering the German advance after mobilization. Military aviators do not place much value on machine guns designed for shooting into the air, and less on rifles installed on the aeroplanes for horizontal attack. It appears to be the general opinion among them that the mastery of the air must be fought in the air, and that aerial battles will be won by skill in operating the machines and high speed. According to their idea, an aeroplane would have to soar over or above its enemy and then *drop* an explosive on it. To do this, the machine must be high-powered, swift and controlled by fearless expert pilots. And that these considerations have passed the romance stage, and are hard facts of the present day—the next big continental war will show Germany is watching the activity of the French with eagle eyes, and the successors of Moltke and Bismarck are not likely to permit themselves to be left in the rear in the fight for control of the air

LIST OF MILITARY AND PRIVATE MONOPLANES AND BIPLANES AND DIRIGIBLES.

	Military Monoplanes.	Military Biplanes.	Private.	Dirigibles.
France	144	190	500	15
Germany	82	57	150	20
Russia	50	64	50	10
Great Britain	16	36	120	8
Italy	26	16	50	7
Austria	25	5	25	4
United States		12		

Arranged in the order of their relative strength up to and including July, 1912; additional machines ordered for delivery in 1913 have been included in this table.

Title Pages for the Scientific American and Supplement

TITLE pages for the last volume of the SCIENTIFIC AMERICAN, the SCIENTIFIC AMERICAN SUPPLEMENT, and AMERICAN HOMES AND GARDENS will be sent free of charge to those subscribers of the three periodicals in question who may wish to bind up the numbers of the last volume.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

High Speed on No. 20 Crossovers

To the Editor of the SCIENTIFIC AMERICAN

After following very closely the controversy in your columns precipitated by Vice-President McHenry, and the complete knocking out by you of every leg which he attempted to stand on in his argument, my attention is drawn to the inclosed half-page advertisement in the *Springfield Republican* to-day, which I presume is being published extensively in the prominent papers through the eastern part of the country, as a large amount of the stockholders' money is being squandered at the present time in this manner

The point to which I wish to call your attention and ask for technical information on is in the first paragraph, which has been marked, as in your argument the statement was made that the No 20 crossovers between New York and Philadelphia daily cared for the trains at full speed As this advertisement purports to be the second time that the "truth has been told," it would appear as though a misstatement was made, as, without further knowledge, I should much prefer to tie to statements which you made regarding the daily operations on the Pennsylvania. H E SCHMUCK

Springfield, Mass.

[The overturning tendencies of a No. 10 crossover are nearly four times as great as those of a No 20 The Pennsylvania expresses daily run through No. 20 crossover at far higher speeds than the slow order speed of 35 miles an hour, and they do so without risk.—EDITOR.]

The Reindeer in Alaska

To the Editor of the SCIENTIFIC AMERICAN

The note about the Alaskan reindeer herds in the issue of August 10th, 1912, calls for some statement of facts as commonly but accurately known throughout interior Alaska. Any success resulting from the introduction of the reindeer into Alaska has been confined entirely to narrow strips of land bordering the oceans, and capable of supporting but a small population A few, a very few, people have been able to make a living with them. These cases have been quoted repeatedly On the other hand, continued and persistent attempts throughout the interior have been expensive failures, because of the scarcity of the variety of moss which the reindeer requires. Mere moss can be found almost anywhere, but the only kind upon which reindeer can live is found only occasionally Consequently, as a draft animal, it is impracticable for the greater part of the country, since long detours must be made in search of food Such detours are expensive and often unsuccessful I recall one instance, happening at Anirk, in the winter of 1908 to 1909 The superintendent of schools for the Government came in one day with several reindeer, drivers, etc They had hunted for suitable moss in vain, and now had to hire native guides to lead the way to the nearest patch, some twelve miles away Arrived there, they had to shovel snow several hours in order to make it possible for the reindeer to reach their food The superintendent was at the time on his way to remove the small herd at Holy Cross, which had been a great expense to the Government during that winter, requiring the continual service of between thirty and forty men, whose main duty was to shovel snow off the moss for the herd.

Your article states that "it is expected that the exportation of reindeer meat will soon become an important industry " This is absurd, as can plainly be seen from the fact that thousands of beeves, as well as sheep and poultry, are annually imported to supply the meat needed There is a continuous but unfilled demand for caribou and reindeer meat. The price of meat here is far higher than in the States, so that a surplus of reindeer meat from the coast herds could much more profitably be shipped here than elsewhere. As it is, the Government itself buys hundreds of beeves to supply meat for the army posts and for the Signal Corps men stationed along the telegraph line.

So it is that, both as a draft animal and as a meat producer, the reindeer has proven a failure in Alaska except in a few localities. For unfrequented trails, the Alaskan dog (Husky or Walamute) is the peerless standby On the mail trails, hard packed and continually used, stage coaches and horse-drawn "double-ender" sleds prevail At each station of the Signal Corps will be found a horse or dogs, according to the nature of the surrounding trails. Meat is shipped in hundred-ton lots or driven in from Cordova or Valdez in herds of hundreds. Practically all reindeer herds have been withdrawn from the interior, since careful attempts have shown that their care and keep far exceeded the returns. In view of these facts, counteracting the limited success in a few places, it is little more than a quibble to make such ambitious claims for the Alaskan reindeer herds.

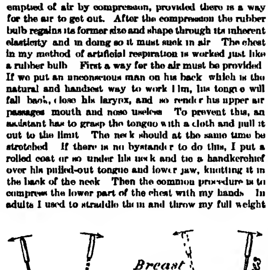
Chena, Alaska. A W WILLIAMS.

Artificial Respiration With a "Lemon Squeezer"

To the Editor of the SCIENTIFIC AMERICAN

Lately a great deal of interest has been shown in resuscitation from electric shock. We live in an age of electricity, and electric accidents are getting to be of every-day occurrence in most places, and, what counts more with the electric companies we have now a national employers' liability law as well as similar laws in some of the States. These laws take their pet defenses away from the companies and lay them open for damages.

Everybody seems to agree that in artificial respiration must be placed our greatest hope in such cases, but how this is to be done there is a difference of opinion The thorax or chest resembles a rubber bulb like those we use on atomizers Now, we all agree that such a bulb can be emptied of air by compression, provided there is a way for the air to get out. After the compression the rubber bulb regains its former size and shape through its inherent elasticity and in doing so it must suck in air The chest in my method of artificial respiration is worked just like a rubber bulb First a way for the air must be provided If we put an unconscious man on his back which is the natural and handiest way to work him, his tongue will fall back, close his larynx, and so render his upper air passages mouth and nose useless To prevent this, an assistant has to grasp the tongue with a cloth and pull it out to the limit The neck should at the same time be stretched If there is no bystander to do this, I put a rolled coat or so under his neck and tie a handkerchief over his pulled-out tongue and lower jaw, knotting it in the back of the neck Then the common procedure is to compress the lower part of the chest with my hands In adults I used to straddle them and throw my full weight



Method of using the "lemon squeezer" I, active inspiration, II, deepest unassisted expiration, III, deepest expiration assisted by levers.

on them—175 pounds. There is no doubt in my mind that this is the most efficient method of artificial respiration, but it is so tiring for the operator that it becomes necessary to take turns at compressing, especially since artificial respiration must be kept up for a long time in all such cases.

Of all the mechanical appliances the lever is the simplest and most efficient, and it occurred to me that a modified lemon squeezer would work well on the chest So I took two boards for levers, and connected them at one end with a cord for a fulcrum Two boards, size about 19 by 3 by ¼ inches, will do I shape them with my pocket knife like flat Indian clubs, drill a hole through one end of each, run a string through the hole in one lever keep the string from pulling through by a knot, and am ready for business

When anybody is shocked around electric work, he should be put flat on his back, his neck stretched, his tongue pulled out to the limit, and his chest compressed with the levers or "lung crutches" as I call them They are simply attached as handles to the chest, and the chest worked like bellows The operator (in electric works the foreman should be so trained) slips the cord fulcrum under the man's chest, runs it through the hole in the other lever, adjusts it with a slip knot to the size of the patient so that the cord is taut behind the back and the handles not quite parallel but a little divergent in front. Then he compresses the chest slowly and easily, keeping time with his own breathing This he keeps up till a physician arrives and takes charge

Such artificial respiration is, as far as the change of air into and out of the lungs is concerned, similar to natural respiration, but is not equal to it. Anyhow, it is the best we can do till a physician arrives and tries to restore the action of the heart by other means.

Cambria, Cal. A. C. MULLER, M D

Risks in Straightening Rails

To the Editor of the SCIENTIFIC AMERICAN

Some few years ago I visited a large mill where railroad rails were being made The person acting as guide showed me all of the various manipulations, and in the end I saw them being made straight by a couple of workmen The process consisted of sighting along the rail, which was shifted back and forth under a press which was thrown in and out of action as the various kinks and bends were subjected to the pressure to straighten them

As I stood there interested in the work I saw two rails snap under the pressure exerted Having noticed a number of articles in the SCIENTIFIC AMERICAN on rail failures it occurred to me that possibly not a few of these failures might be traced to a small incomplete fracture caused at the time of straightening developing into a complete one I would not attempt to offer any suggestion as to a better way to straighten a rail, but surely any act which would break a rail could develop a crack which might develop into a complete fracture with disastrous results

Do you not believe that a careful examination along these lines would result in an explanation of why an apparently sound rail suddenly goes to pieces?

Nephi, Utah H G GOULD

[Our correspondent draws attention to a practice which has been criticised as liable to do permanent injury to a rail Cold straightening is undesirable to say the least the rails should never be straightened when they are below a certain fixed temperature —EDITOR]

The Transmutation of the Elements

To the Editor of the SCIENTIFIC AMERICAN

The interesting article which appeared in the August 24th issue of your valuable paper, "Can the Baser Metals be Changed to Gold?" attracted especially my attention because closely following an article where the same argument is masterly treated by Prof I Soddy of Glasgow University

Let me consider two possible sides of the transmutation problem, viz transmutation from light to heavier atomic weight elements, and transmutation from heavy to lighter atomic weight elements

The first side of the problem offers enormous difficulties and is obviously unsolved

The latter from your writer's point of view, seems to be solved by Sir W Ramsay's and Cameron's experiments

Mr Rutherford's criticism is reported and I will add that of Mr Soddy who clearly states in the article referred to that The energy of sub-atomic changes is thus of the order of a million times greater than the energy of ordinary chemical or molecular changes The energy evolved from the disintegration of a single atom is detectable by radioactive methods, whereas a million million atoms of any non-radioactive element is a quite undetectable quantity even with the spectroscope For this reason the identity of the final non-radioactive product of the whole sequence of changes still remains uncertain "

As a matter of fact, Mr Soddy is referring here to radioactive series disintegrations, not to artificially produced transmutation but he next points out that "The fact that it has been found quite impossible even by the most powerful agencies known to alter artificially the rate at which a radioactive substance is changing either to retard or to accelerate it, is obviously the corollary to the well-known impossibility of artificially transmuting one element into another "

It seemed to me necessary to note this discordance in judgments for the proper comprehension of the importance of transmutation that is going to take the preponderant place among the big problems of modern science, both chemical and physical.

Buenos Aires RICO S MARZONI

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¹ Transmutation the Initial Problem of the Future, *Scientia* xxii 3, pp. 186–202

The Modern Automobile Torpedo

The Story of a Great Invention

By Robert G. Skerrett

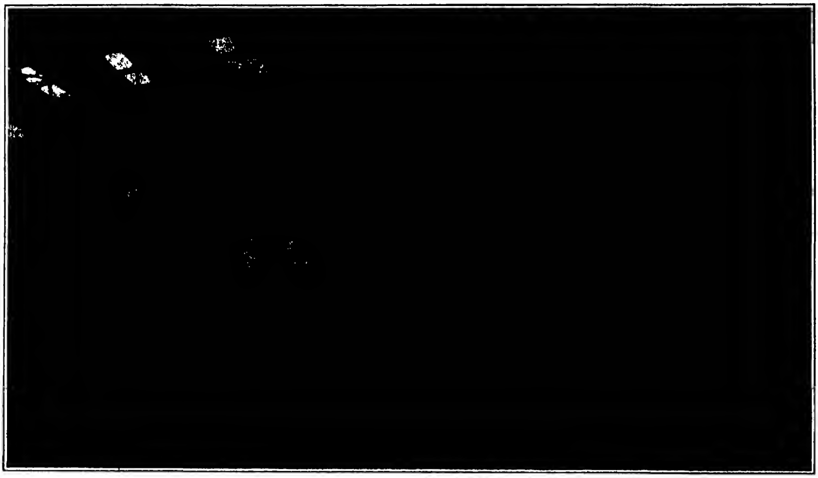
THE modern automobile torpedo so far as its inception is concerned is forty seven years old In 1864 Capt Lupuis of the Austrian Navy realizing the potential destructive powers of a torpedo capable of self propulsion conceived a type of miniature fire-ship or floating torpedo which could be directed from a fixed base by guiding lines Capt Lupuis proposed to propel his torpedo by means of clockwork or steam, but he had not personally the mechanical knowledge needful for the proper development of his weapon At that time Mr Whitehead, an Englishman and a man of exceptional mechanical skill was in charge of an engineering plant at Fiume, and to him Capt Lupuis turned for assistance The net result of the association was the awakening of Mr Whitehead to the field thus offered to engineering cunning Abandoning Capt. Lupuis scheme entirely Mr Whitehead set about devising a torpedo capable of self propulsion and self-direction—after once being started on its way—which, unlike the crude surface affair of Capt. Lupuis, should be able to run under water and safe from gun fire

financial position to obtain exclusive rights to the invention

From the modest 14-inch torpedo of 1864, with its limited range and speed, we have reached to-day a weapon weighing more than 1,600 pounds and capable of covering ranges up to 7,000 yards—traversing this distance in the remarkably short period of less than seven minutes. This particular torpedo is the invention of Lieut. Hardcastle of the British Navy In our own service we do not claim the same long range—4,000 yards being the maximum upon which we now place a military value, and the remaining speed at the end of this run is in the neighborhood of 28 knots. The explosive charge of the present-day automobile torpedo varies from 140 to 250 pounds of gun-cotton. The destructive force of a blow of this sort has been amply demonstrated recently by practical tests against the under water bodies of fighting ships. To-day, the builder of battleships can hope only to restrict the area of under water damage by subdividing his ship below the waterline into numerous water tight compartments. One torpedo will probably not be able to sink a dread

the value of the gyroscope, however, other minds promptly set about improving this instrument of lateral guidance. To begin with, the adoption of ball-bearings, nicer balancing, and the refining of various moving parts made it possible to lengthen the directive period of the gyroscope as well as to increase its sensitiveness—thus insuring a more reliable run and a speedier one by flattening the sinuous course The next developments introduced an air-impulse, turbine-driven gyroscope, and then an electrically-driven Obry followed. These have done away with the shock of the original spring impulse and have naturally greatly increased the directive value of the gear, besides making it possible to fire the torpedo from a broadside and cause it to swing automatically through an angle of 90 degrees toward a target dead ahead. From a weapon that was a menace to friend and foe alike, the installing of the gyroscope has revolutionized the automobile torpedo, making it under some conditions even more certain of hitting its mark than that possible with the biggest of our modern guns.

For years the wonderfully compact and efficient



Sweating in the ends of the air flask or "middle body" of a torpedo.

No 1 is the forebody or head of the torpedo 2 is the "middle body" or air flask 3 is the after body of the torpedo.

THE MODERN AUTOMOBILE TORPEDO

Some time in 1864 Mr Whitehead built in secret his first torpedo This weapon was a relatively modest effort having a diameter of 14 inches, weighing but 300 pounds, and carrying a charge of but 18 pounds of dynamite The motive power was compressed air stowed at a maximum pressure of 700 pounds per square inch and the torpedo was capable of making about 6 knots an hour for a short distance As soon as this torpedo was subjected to test in the water, Mr Whitehead was brought face to face with some of the harder problems of his undertaking. One of these was the task of properly controlling the submerged running Instead of keeping at a uniform depth the torpedo divided its time uncertainly between the surface and the waterbed, and it was seemingly impossible to keep it within the desired bounds. After four years of patient experimenting Mr Whitehead evolved his "balance-chamber"—for years guarded by every effort to keep it secret—by means of which the submergence of the torpedo became automatic the movement of a pendulum combined with hydrostatic pressure serving to actuate certain controlling mechanisms which, in their turn operated the diving rudders The Austrian government was the first to give official recognition to Mr Whitehead's work but was not in a

nought but it will be likely to so impair her military efficiency as to make her an easy mark for deliberate annihilation either by gun-fire or further torpedo attack.

Only a few years ago, comparatively speaking, the lateral course of the torpedo was decidedly uncertain, to put it mildly The range and speed had been greatly improved, but the torpedo still had a way of departing suddenly and mysteriously from its intended course—sometimes coming back at the vessel from which it was sent to the no small dismay of all hands. This was not a pleasant thing to contemplate in time of war when the head of the weapon would be loaded with its violently destructive charge. At this critical stage in the history of the torpedo, the Obry gear was invented. Briefly, the Obry gear consisted of a gyroscope placed within the torpedo and so connected by intermediate power mechanisms with the directive rudders that the weapon could be held to a fairly straight course or, more properly, to a sinuous one consisting of a series of flattened curves alternating from right to left. The original Obry gear had a spring impulse, its directive force rapidly diminishing from the instant of starting, and it became quite useless after the torpedo had run something over a thousand yards. Realizing

three-cylinder Brotherhood engine was the best available motor for the automobile torpedo, but even with its progressive developments it had the inherent limitations or drawbacks of the reciprocating engine, and it was only logical that the torpedo builder should cast about him for a motor capable of utilizing still better the power stored in the air flask. The turbine was the natural solution of the difficulty

All the while that the torpedo was improving in military value, the range of modern guns on shipboard was likewise undergoing substantial increment—making it possible for ships to fight at greater distances, and the torpedo expert realized, despite all that had been done to make his weapon more effective, that both the range and speed of the torpedo must be further increased if it were to meet properly the changed conditions. This was a staggering realization, because there were difficulties in the way of making a larger torpedo susceptible of easy handling, and it was not practicable to add much either to the capacity of the air flask or to the pressure of the energy stored therein. At this critical stage, American inventive skill found a way to surmount the obstacle. Mr Frank M. Leavitt, of the E. W. Bliss Company, made the starting proposal to heat the air stored in the flask, and thus to

cause its expansion and multiply its propulsive capacity. The first American development of the super heater for this purpose consisted of means by which alcohol could be burned within the air flask—the heated air passing thence through the valve system to the engine or turbine and, while still relatively warm passing outboard through the exhaust. Apart from propulsive advantages, superheating obviated another objectionable feature of the older system in which the changes of temperature were so great—due to the rapid expansion of the compressed air—that the ex haust was frequently far below the freezing point. This caused the lubricants to congeal and, in turn impaired the action of moving parts. The British development of the superheater omitted the alcohol flame from within the air flask and put it between the reducing valve and the motor. This was an advantage in some ways. It did not require the heated air to pass through the delicate valve system, it fed into the engine the air at its most efficient temperature, and it made possible a nicer control of the pressure at the during the entire run of the torpedo as he first did, he, too, heats the impulse supply outside and between the reducing valve and the turbine, but, in order to make use of more of the stored air than possible heretofore he causes the ignition of an alcohol flame inside of the flask toward the latter part of the run. By this means he is able to use to good effect 174 pounds of the original 191 pounds of the compressed air—thus increasing the range and the maintenance of higher speeds throughout the longer run.

Without giving away state secrets, the following table will show what the superheater has made possible in the case of an 18-inch torpedo. These figures are very instructive.

Speed in Knots.	Air Unheated	Air Heated
At 1 000 yards	35	44
At 1 500 yards	30	40
At 2,000 yards	28 25	38
At 3 000 yards	23-24	32
At 1 000 yards	18 20	28

called Calaminæ (i e, 'made of reeds''), in Lydia, which were not only driven by the wind but could be pushed about from place to place with poles.

Floating gardens—some natural and some artificial—have flourished in many parts of the world from early times. They are particularly advantageous in regions exposed to floods where a garden planted on *terra firma* would be ruined by these occurrences, while the floating garden is undisturbed by the rise of the waters. The famous floating gardens of Kashmir are a case in point.

The lake of Xochimilco, near the city of Mexico, is nearly covered with floating gardens called *chinampas* on which are raised vegetables and flowers for the city markets. They are formed of floating masses of water plants covered with soil and secured by poplar stakes. The latter take root and surround the islands with living hedges.

Among the largest of natural floating islands are those formed by tangled masses of trees and brush wood carried down by great rivers. On the Mississippi

A longitudinal section through a Bliss-Leavitt torpedo, showing the disposition of the explosive, the driving machinery, and the propellers.

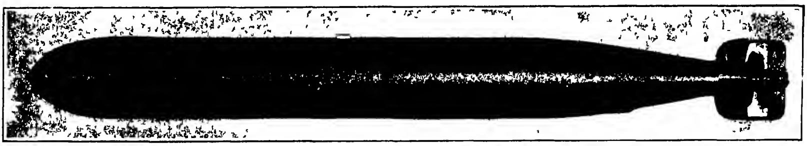
P plunger or striking rod. *G*, safety pin. *C*, guncotton charge. *D*, detonating charge. *B*, air-flask. *J* charging valve. *K* hydrostatic valve. *H*, pendulum. *M*, turbine. *N* submergence control mechanism. *S*, submergence valve. *S H*, superheater. *X* valve case. *Y*, air lever. *O*, immersion servo-motor. *L* pressure regulator. *V* gyroscope. *T* gyroscope impulse. *U*, servo-motor. *I I* rudders for horizontal control. *G*, *H*, rudders for vertical control. *F* and *G*, rudder controls. *E*, *E*, propeller shaft. *I I* propellers. *R*, shaft gearing. *A* after body. *L*, *B* ballast.

Testing stand used in ascertaining the accuracy of the gyroscope's control, which has revolutionized the automobile torpedo.

No. 1 shows the torpedo without the head attached. No. 2 shows the middle body and the after end of the air flask with superheater flasks in position.

Ericsson's automobile torpedo of the 70's, built in this country, and tested at the United States Naval Torpedo Station at Newport.

This dirigible torpedo was designed to rival the Whitehead and the Lay torpedoes. It never survived the experimental stage. It was driven by compressed air.



One of the latest types of the Bliss-Leavitt torpedoes, showing the three separate sections of the torpedo in their assembled condition ready for service.

THE MODERN AUTOMOBILE TORPEDO

engine or turbine. However, like all good things, it had a drawback from a military point of view. When the air flask of one of our torpedoes is fully charged, the actual weight of that compressed air amounts to something like 191 pounds. The reducing valve, which regulates the pressure and supply of air to the motor—standing sentinel between the air flask and the propulsive mechanism—is designed to maintain a feed pressure of 300 pounds for the turbine impulse. When the pressure in the air flask approaches 300 pounds, the run of the torpedo is substantially at an end so far as its useful military speed is concerned. As the air in the air flask expands due to its gradual escape to feed the motor, the temperature is lowered sometimes even to below zero, and this remaining air is incapable of expelling itself from the flask for the purpose of effecting the propulsion of the torpedo. It has been found that when the superheater is outside of the air flask, of the total weight of 191 pounds of stored energy, not more than about 148 pounds are utilized. Again Mr Leavitt's ingenuity has supplied a remedy. Instead of heating the air within the flask

This article has reviewed only the more startling features of development in the so-called Whitehead automobile torpedo, but it must not be imagined that there have not been numerous other directions in which the weapon has been modified and bettered to overcome the cunning of the defense. These, however, contributing as they do to improve effectiveness and precision of action in one direction or another, are matters of detail which cannot be touched upon within the space of this contribution—interesting as they undoubtedly are.

Floating Islands

THE imagination of man has always been impressed by floating islands. In ancient times such islands were regarded with superstitious reverence, and the romantic story of Delos—the natal isle of Apollo and Artemis—is but one of many cases recorded in classical literature of vagrant islands in the sea. Pliny says that in the lake of Vadimonis there is a dark wood which is never seen in the same place for a day and a night together, and he describes the islands

and its tributaries these islands are known as "rafts." One of the most remarkable of these rafts began forming in the Atchafalaya, one of the lower arms of the Mississippi in 1778, and gradually increased until by 1816 it had extended to 10 miles in length, over 600 feet in width, and 8 feet in depth. Although it rose and fell with the water it was solid enough to support the growth of trees, some of which were 60 feet in height. This vast obstruction was finally removed by the State of Louisiana at great expense. The work began in 1835 and lasted four years. In more recent times a great raft in the Red River completely blocked the channel for 45 miles, until it was removed by the National Government.

Where a mat of vegetation borders the seashore the action of waves sometimes breaks off large islands. This was probably the origin of a remarkable floating island which was first seen in the Atlantic Ocean about 400 miles east of the New Jersey coast in July, 1892. Its area was about 9 000 square feet and it bore trees 30 feet in height. When again seen in the following September it had traveled over 1 000 miles.

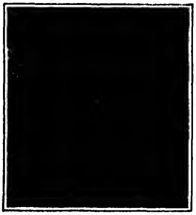
Turntable for Cars

IN the majority of garages there is very little room for the easy maneuvering of automobiles and a great deal of time is wasted in trying to turn a car about, particularly if it has to make a right angle turn to reach the elevator which will carry it to the shop. The accompanying picture shows a special form of turn table adapted to overcome the necessity of tedious maneuvering. The turntable is similar to that used for locomotives. It may be rotated by a single man by using a bar to engage any one of the several small holes in the outer edge of the table. The table itself is built of reinforced concrete and hence is proof against water and fire. The diameter of the table here shown is fourteen feet, so that it will take the largest touring car. It has been found of great convenience when adjustments or repairs must be made for the car can be swung around without any trouble to the best position to obtain all the available light.

Readers are invited to contribute photographs of novel and curious objects, unique occurrences and ingenious contrivances. Such as are found available will be paid for promptly.

An automobile turn-table for garages.

The original cave in Arizona.

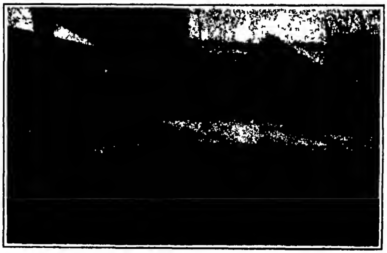


Reconstructing the cave in New York.

New York's Cave of Stalactites

ONE of the most noteworthy forthcoming exhibits in the Mineral Hall, at the Museum of Natural History, New York, will be the representation of a beautiful cave of stalactites and stalagmites. This will be a reproduction of almost an entire cavern recently discovered in the Copper Queen Mine, at Bisbee, Arizona. Here, a quarter of a mile below the surface, during the mining operations of blasting for copper, a spacious chamber was uncovered containing a series of terrace like grottoes adorned with a wealth of magnificent and many-colored stalactites and stalagmites. Dr. Douglas and the mining company placed the find at the disposal of the museum. Dr. Edmund Otis Hovey, Curator of Geology and Invertebrate Paleontology, with three assistants visited Bisbee to collect and bring back the original material so as to form an exact reproduction of the Arizona cave. A half a hundred boxes, containing the choicest formations from the walls, floors, ceilings, etc., were brought back. They weighed from one pound to nine hundred. The delicate task of setting up the pieces in the cave at the museum is being executed by Mr. William Peters, artist of the museum staff, who accompanied the expedition to Arizona.

A steel frame 12 feet high by 8 feet wide forms the outside of the cave, which will be covered with limestone blocks, taken from the mountain under which the cave was found. These wonderful formations of stalactites and stalagmites are made through the evaporation of percolating waters. The most striking feature of the reconstructed cave will be a stalagmite 3 feet in diameter and 3½ feet high, of a beautiful green color, and weighing about 900 pounds. This stalagmite is remarkable on account of the radiating clusters of pointed calcite crystals thickly set all over it but diminishing in size from the bottom of the column upward.



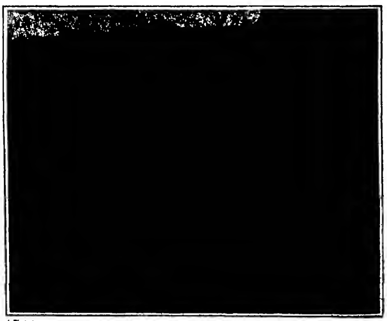
A rotating ice disk, naturally formed.

Electricity and Diet

SCIENTISTS have been looking for some method of replacing the multiple aliments which are needed to keep up the human body by food in a concentrated state, so that it could be absorbed with less fatigue. On the other hand a French scientist, Prof. Bergonié, claims that electricity will solve the problem. We have already mentioned some results which he obtained in this direction, according to the account presented by him to the Science Advancement Congress. Since then he has continued his researches and arrived at results which have almost a sensational character. Before this he simply proposed the idea that electricity could be made to replace food, that is by adding to the heat energy absorbed by the body, so that less food need be taken into the system. At present he is making actual experiments which appear to prove this conclusively according to his communication made to the Academy of Sciences. The experiments were made during the last few months at his laboratory at the Bordeaux University and fully confirmed his theories on the subject. His method, known as "diathermy," or application of low tension and high frequency currents to the human body, is able to make up for a part of the alimentation of the system by furnishing a large amount of heat to the body, instead of producing the heat from food materials which need to be consumed or indeed burned in the system, this giving rise to overwork of the physiological organs of the body. Such electric currents, as Prof. Bergonié says, will pass through the body without causing the least feeling, and with a current of 2 to 3 amperes strength and a voltage of 1,000 to 2,500 volts per hour about 1,000 calories of heat can be furnished per hour, this being over one third of the daily food ration. The following test will bring out the remarkable results which can be obtained by this method. He applied the electric treatment to a man 5 feet 10 inches high, whose weight before the treatment was only 110 pounds. The patient ate a great deal of animal food, but was in very bad condition, as he could not walk over 300 feet without needing aid. He was unable to work and was very sensitive to cold. After a series of treatments of 40-minute duration by the electric method, this corresponding to an absorption of heat equal to about 1,700 calories each time, the patient began to improve rapidly, and at the end of the treatment he gained considerably in weight. In fact, he then weighed as much as 140 pounds, which makes a gain of about 30 pounds. Dr. Bergonié states that the patient can now walk for hours without fatigue, and his physical vigor is restored to the normal. He is able to stand all degrees of heat and cold, and his general appearance is very good. The author considers that the time is not far distant when all troubles due to insufficient nutrition will disappear under a series of electrical treatments by high frequency currents according to the general method of M. d'Arsonval.

A Frozen Whirlpool

WE have received from a reader in Schenectady, New York, the accompanying photograph of a most unusual ice phenomenon. As the result of rotary currents in a mill pond, a large circular piece of ice nearly six feet in diameter was formed and kept separate from the main body of ice, owing to its continuous motion. The disk was almost a perfect circle, and moved slowly from left to right. This phenomenon occurred last winter. The unusual condition continued for several days until the ice had obtained a thickness of nearly two inches.



I. Illustration.

Statue of Marcus Aurelius removed from his horse for repairs.

Marcus Aurelius Unhorsed

THE noble statue of Marcus Aurelius in the Capitol Square of Rome has suffered severely from the ravages of time. Recently it was found that the precious bronze was urgently in need of repairs. The only thing to do was to remove the Emperor from his horse, and take him to the museum of the Capitol, where the rents in his garments and the scars on his limbs could receive proper scientific treatment. A scaffold was built over the statue and the Emperor was firmly bound by the legs and chest and then lifted from his horse by means of suitable tackle. Our illustration pictures him as he is being lifted and shows that even in this trying position he was not lacking in stoic gravity. While the Emperor was undergoing repairs at the museum his horse was completely boxed in by a temporary wooden shack. When the figure was removed from the horse there was considerable agitation on the part of a faction of young Italians who were anxious to have him replaced by a statue of Cæsar. Fortunately for the memory of the great Marcus Aurelius, this agitation was unheeded by the authorities.

Power of a Microscope

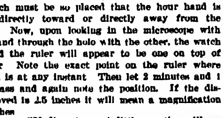
By C. W. Nieman

AMATEURS who have a microscope miss a great deal of the pleasure and interest to be derived from its use unless they are able to find the magnifying power of their instrument and to measure objects with which they are working. It is surprising how much more intimate an acquaintance with an animalcule or portion of an insect is obtained if we are able to say that it is 3/1,000 inch in diameter, or whatever else its dimensions may be.

In order to measure objects under the microscope it is first necessary to find its magnifying power, or, in case the instrument has several objectives and eye-pieces and the tube can be changed in length, to find the magnifying power under the various conditions in which it is used. All the methods the writer has seen involve the use of an object of known length which can be observed under the microscope. This usually consists of a pair of lines ruled on a glass plate at known distance apart, and can be bought for a couple of dollars. This outlay, however, is unnecessary if the following method is employed.

Take a good watch and measure the exact radius of the hour hand, that is, from the tip to the center of the pivot. Suppose this is found to be 0.57 inch. Then the path of the point in 12 hours will be $2 \times \pi \times 0.57 =$ 3.58 inches. Therefore, it will move 1/100 inch every 2 minutes and 1 second. If the crystal is opened and the microscope focused on the tip of the hour hand, in 2 minutes and 1 second it will have moved 1/100 inch, and will fill the same purpose as the lines ruled on the glass. To the side of the barrel of the microscope fasten a piece of sheet metal with a small hole in one end and bent as shown. The distance between the hole and center of the eye-piece must be the same as the distance between the experimenter's eyes. On the table below the hole fasten a ruler running across the table, i. e., forward and back from the operator and exactly 10 inches from the hole. This 10 inches is the arbitrary distance selected in this country for such measurements. The watch must be so placed that the hour hand is moving directly toward or directly away from the operator. Now, upon looking in the microscope with one eye and through the hole with the other, the watch hand and the ruler will appear to be one on top of the other. Note the exact point on the ruler where the hand is at any instant. Then let 2 minutes and 1 second pass and again note the position. If the distance moved is 2.5 inches it will mean a magnification of $\frac{2.5 \text{ inches}}{0.01 \text{ inch}} = 250$ diameters. A little practice will enable a person to hit the time very closely. This can be repeated for various conditions, for low power lenses a greater distance than 0.01 inch being taken and for higher powers perhaps a shorter one.

The next thing is to construct a scale for the measurement of microscopic objects. The scale reads in thousandths of an inch, but each thousandth inch is magnified according to the power of the microscope. Thus, where the magnification is 250 diameters the "thousandths" will be ¼ inch apart. The proper length and divisions for the scale (or scales in the case of several objectives) can be figured and can then be drawn on a strip of cardboard. To measure an object it is only necessary to put the scale in the same position as the ruler in the first experiment. The object will then appear right on top of the scale and can be measured as easily as a carpenter measures a board. *Caution*. Always hold the scale at right angles to the nearest edge of the table. If it is laid parallel to a line connecting the hole and the eye-piece it will be nearly impossible to make a measurement. This is easily proved by trial. Also remember that the scale must be 10 inches from the hole. If this is an inconvenient distance owing to the shortness of the microscope any other distance can be adopted, as 8 inches, but in this case each division must be 8/10 as long as for the regulation distance.



Device for measuring the power of a microscope.

How to Remove Black Paper Strips from a Film Back

By Stanley P. McMinn

IN removing the black paper strips from a film pack such as commonly is used by countless numbers of amateur photographers, trouble not infrequently is experienced by reason of the paper tearing off before it has been completely withdrawn. Under ordinary circumstances, in order to nullify the effect of the remaining piece of black paper, it is necessary to pull out the next flap, thereby sacrificing one exposure. It is quite possible, however, to remove the section of black paper without destroying the exposure or disturbing the film remaining in the pack, with the aid of the gummed portion from an envelope. The envelope flap first should be trimmed to the width of the film pack, an envelope made of fairly heavy paper would better be used, though almost any thickness will serve the purpose. Then if the gum is moistened, which by reason of the slippery nature of the mucilage will operate to lubricate it, little difficulty will be experienced in slipping the improvised "fish" down between the torn-off paper and the next black strip in the pack. Care should be taken, of course, to ascertain that the gummed portion of the envelope comes in contact with the torn paper and not with the next black strip. The envelope should be permitted to remain in position for about 10 minutes, or until the gum has had time to harden thoroughly, when it will be a simple matter to draw out the torn strip by grasping the free end of the envelope.

An Interesting Static Electric Motor

By H. B. Dailey

FOR exhibiting in an entertaining way the effects of static electric attraction and repulsion, and for stimulating an interest in the observation and study of these phenomena there is perhaps no form of demonstration apparatus more effective than a static electric motor. While examples of static motors have occasionally appeared, the degree of mechanical skill involved in their making has usually been such as to discourage attempts at amateur construction. The features of extreme simplicity possessed by the efficient little motor here described should therefore commend it to the home experimenter.

The "tumbler" static electric motor

The apparatus employs three large equal sized tumblers of thin blown glass. The central tumbler, inverted, revolves upon a pivot pointed stem of 3/16 inch steel wire whose upper end enters a small indentation drilled in the exact center of the tumbler's bottom. A lower bearing is provided by fitting into the mouth of the tumbler a centrally apertured disk of stiff mica through which the supporting rod passes, the disk being secured in place with a little shellac applied to its edge. To keep the pivot stem from wearing the mica, a copper cent drilled to an easy running fit for the rod is attached to the mica disk with sealing wax. The tumbler, which is raised about an inch above the base, has cemented with shellac upon its outer surface eight equally spaced vertical strips of tinfoil 5/16 of an inch wide, with rounded ends, and of a length about 3/4 of an inch shorter than the length of the tumbler.

Upon opposite sides of the inverted tumbler and quite close to it are placed two similar tumblers, right side up, their bottoms fixed with shellac into snugly fitting recesses bored in the wooden base of the instrument. Each of the fixed tumblers has cemented upon its inside surface exactly facing the central tumbler a vertical strip of tinfoil ⅝ of an inch wide, rising from the bottom of the glass up to within ⅝ of an inch of the upper rim, the lower ends of these tinfoil strips, or field strips as they may be termed, being electrically connected with vertical knob-tipped metallic rods fixed in the centers of the outer glasses with a setting of plaster of Paris.

Lastly, from one of the upper corners of each of the field strips (from corners diagonally opposed on the field, strips face each other in the apparatus) a narrow tinfoil extension ⅛ of an inch wide rises vertically to the rim of the glass over which it passes, and terminates ⅜ of an inch down the outside of the tumbler. On connecting the two balls at the tops of the vertical rods with the opposite poles of a static machine, the central tumbler immediately begins a rapid rotation which continues to increase until the apparatus fairly hums.

In starting, the foil sectors on the central tumbler are at first attracted by the charged field strips within the outer glasses. As the sectors move into position opposite the field strips they receive sparks from the latter and become similarly charged, when repulsion ensues. Moving forward with the rotation of the tumbler they soon come within the influence of the oppositely electrified field strip on the other side and are strongly attracted, until as they pass the field strips, their electrification is reversed and the cycle is repeated. The moving sectors receive their sparks from the tips of the field strip extensions whose lateral displacement prevents the electrification of the sectors until the latter have come opposite the exact center of the field strips. The "tumbler" motor is a fascinating little machine to watch in operation, and when one sees its vigorous rapid action it seems incredible that the motive power is static electricity. The instrument operates satisfactorily from a very small static machine.

To Fill a Barometer Tube

By Henry H. Riggs

AMATEURS who have to fill or refill their own barometers are sometimes greatly troubled by the residuum of air which will remain in the tube in spite of all precautions, and spoil the vacuum and the accuracy of the barometer.

The following will be found a very helpful trick, though it will not take the place of other precautions for keeping mercury and tube clean.

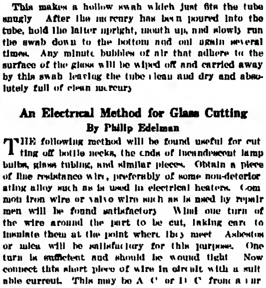
Take a piece of soft iron stove wire, and wind half a dozen turns around a large nail or rod of such a size that the coil will just slip inside the barometer tube. The coil must be a close one, with no spaces between the turns. Straighten the rest of the wire out so that it lies parallel to the axis of the coil. Finally wind a piece of cotton yarn in the coil so that it lies snugly in the groove between the turns of wire, bring one end through the coil and tie.

This makes a hollow swab which just fits the tube snugly. After the mercury has been poured into the tube, hold the latter upright, mouth up, and slowly run the swab down to the bottom and out again several times. Any minute bubbles of air that adhere to the surface of the glass will be wiped off and carried away by this swab leaving the tube clean and dry and absolutely full of clean mercury.

An Electrical Method for Glass Cutting

By Philip Edelman

THE following method will be found useful for cutting off bottle necks, the ends of incandescent lamp bulbs, glass tubing, and similar pieces. Obtain a piece of fine resistance wire, preferably of some non-deteriorating alloy such as is used in electrical heaters. Common iron wire or valve wire such as is used by repair men will be found satisfactory. Wind one turn of the wire around the part to be cut, taking care to insulate them at the point where they meet. Asbestos or mica will be satisfactory for this purpose. One turn is sufficient and should be wound tight. Now connect this short piece of wire in circuit with a suitable current. This may be A. C. or D. C. from a current tap or from a battery. If a current tap is used a resistance should be connected in series so as to avoid a direct short circuit on the line. If a battery is used it must have sufficient voltage and amperage to heat the wire. Allow the wire to come nearly to a white heat for a short time and then plunge the glass piece into some cold water. Holding the piece under a water tap will also do. The piece should then break cleanly at the point covered by the wire. The same general method can doubtless be applied to a variety of uses. There seems to be a limit to the size of a piece which can be cut in this manner, however. The worker can soon find the limits and then use the method to the best advantage.



Cutting glass with electric heat

The hot wire heats the glass in a restricted place which can be regulated by the worker as desired, and the heat does not spread all over the glass so as to cause an irregular break. The glass coming into contact with the cold water is subjected to considerable strain at the heated portion and consequently either breaks or cracks.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel

SAFETY ATTACHMENT.—W P Aldan 25 Burnside St. Portland, Ore. This is an inexpensive device adapted for safeguarding a watch by attaching it to the clothing wherein a support is provided for the watch which will permit the watch to be taken from the pocket for inspection and returned without releasing the watch from the fastener or the fastener from the clothing

GARMENT SLEEVE.—A Goldberg 184 W 20th St Manhattan New York N Y. The invention refers to sleeves of garments such as shirts shirtwaists and the like and has reference more particularly to a garment sleeve having a cuff portion adapted to be held in different positions, and a part normally concealed by the cuff portion and constituting means for holding the cuff portion in a raised position

Of Interest to Farmers.

SEED PLANTER.—C Knopp care of H A. Turner R. F D No 1 Winnoe Minn. An object of this invention is to provide an implement which will be so efficient in action as to drop the seeds in sufficient number and at such distances apart as to avoid the waste of seed and labor in subsequently chopping out the superfluous plants.

DEVICE TO PREVENT DOGS FROM WORRYING SHEEP.—W Graham Cookshire, Quebec Canada. The object here is to provide a device which may be fastened to the nose of a dog and which is provided with hooks which will become entangled in the wool of a sheep so that when the sheep starts to run the dog's nose will be pulled, and the latter receive a lesson which will break him of his sheep worrying habit

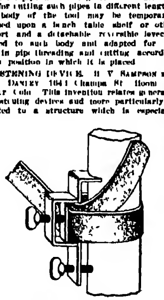
Of General Interest.

HORSESHOE CALK.—W Gordon 1743 N 8th St Philadelphia Pa. The object here is to provide a construction which will be easily applied to and removed from the horse's hoof at will, when in place be securely held against displacement in any direction and will embody means which will aid in the adjustment of the attachment to hoofs of different sizes

Hardware and Tools.

COMBINED PIPE VISE AND PIPE CUTTER.—C Brock 1721 Harford Ave Baltimore Md. This tool is for clamping and holding metal pipe while being screw threaded and also for cutting such pipes in different lengths. The body of the tool may be temporarily clamped upon a bench table shelf or other support and a detachable reversible lever is pivoted to such body and adapted for use both in pipe threading and cutting according to the position in which it is placed

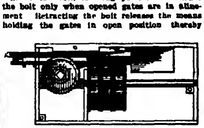
FASTENING DEVICE.—H V Sampson and S T Daniey 1041 Champa St Room 17 Denver Colo. This invention relates generally to fastening devices and more particularly is directed to a structure which is especially



FASTENING DEVICE.

adapted for securing the lines from the bridle bit or halter of a horse in order that the animal may be hitched to a post or other support. It provides a device especially adapted for this use which may co-operate with any hitching post or pole it being adapted to efficiently perform its purpose and at the same time being inexpensive in its make-up. It may be easily carried on the person and adapted for use with any hitching post in order to secure the reins or lines extending from the bridle bit or halter in order that the animal may be hitched. A perspective view of the device in operative position is shown in the engraving.

COMBINATION MASKET LOCK.—N S G Hagarity 808 Sussex St Paterson N J. In this simplified form of lock the combination to permit the actuation of the bolt may readily be changed from the outside of the lock. In this invention it is possible to draw the bolt only when the tumblers are in the position in which they were set when the bolt was thrown. A number of wheel-shaped tumblers are provided, having gates in their peripheries, which gates are adapted to be opened to permit the throwing of the bolt, which gates are locked in their open position after the passage of the bolt, it being possible to retract the bolt only when opened gates are in alinement. Retracting the bolt releases the means holding the gates in open position thereby

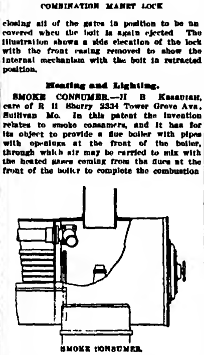


COMBINATION MASKET LOCK

closing all of the gates in position to be uncovered when the bolt is again ejected. The illustration shows a side elevation of the lock with the front casing removed to show the internal mechanism with the bolt in retracted position.

Heating and Lighting.

SMOKE CONSUMER.—H B Kasabian, care of R H Sherry 2334 Tower Grove Ave., Sullivan Mo. In this patent the invention relates to smoke consumers, and it has for its object to provide a flue boiler with pipes with openings at the front of the boiler, through which air may be carried to mix with the heated gases coming from the flues at the front of the boiler to complete the combustion



SMOKE CONSUMER.

Various applications of the invention may be used since the invention includes all constructions in which air is admitted between the fire chamber and the smoke stack whether flue boilers are used and whether the boilers are stationary or of other types. The engraving represents a sectional view showing the front of the boiler supplied with the smoke consumer

Household Utilities.

TRANSOM LIFT.—O W McCarty and D. F Harness care of D F Harness & Son Oklahoma Okla. The invention is an improvement in transom lifts, and the aim is to provide a simple inexpensive easily installed device by means of which the transom may be swung into any desirable position and so held and having automatically acting means for preventing accidental movement of the transom

BURNER.—J D Langston, 2502 5th Ave., Birmingham Ala. This burner is for use in cook stoves, ranges or heaters, adapted to utilise oil for fuel. The device is provided with means for gasifying the oil and burning the gas which may be applied to existing stoves, ranges or heaters, with slight changes to the stoves, ranges or heaters.

JAR COVER STRAIGHTENER.—R. S Knutson Steward Ill. In the present patent the invention has reference to household devices, and particularly to means whereby common metal fruit jar tops may be straightened after being distorted, and used repeatedly instead of discarding them unnecessarily

Machines and Mechanical Devices.

HYDRAULIC JACK.—F Lent 283 W 54th St New York N Y. The invention provides a jack for use on heavy trucks and the like and arranged to permit of conveniently raising the part without requiring much physical exertion on the part of the operator, to allow quick lowering, and to retain the liquid for re-use without danger of leakage

METAL ROLLING MACHINE.—J K Hauberg, care of J S Moothard, Cando N D. The distinguishing feature here is a roller carried by a reciprocating frame and adapted to act on a heated metal plate while held on an anvil block, and mechanism for adjusting such block higher or lower, or at different angles, according to the bevel it is desired to impart to the plate

YARN CONDENSER AND POLISHER FOR CORDAGE SPINNING MACHINES.—O Nenvidek R F D No 2, Milwaukee, Ore. This invention is an improvement in so-called nippers or machines designed for treating, that is to say condensing and rounding and polishing hemp, yarn or slivers preliminary to spinning for making ropes and cordage

PULLEY BRAKE FOR MOTOR CONTROLLED APPARATUS.—M. Tainman 241 Wooster St., New York, N Y. This inventor provides a readily actuated brake mechanism for simultaneously manipulating the brake to apply the same when the power is shut off, said mechanism having means for adjusting the support of the brake whereby the wear in the latter may be taken up and the effectiveness of the brake action varied.

Prime Movers and Their Accessories.

ROTARY ENGINE.—C. B. Eann, care of A. B. May 106 Wilder Bldg., Rochester, N. Y. This invention provides a simple form of connecting mechanism between the pistons whereby the intermittent and step-by-step partial rotary movements thereof shall be automatically controlled and whereby the intermittent rotations of the pistons through the inter-connecting controlling mechanism will result in imparting to a driven shaft a continuous rotary movement

STEAM HYDRAULIC INTENSIFIER.—T E Holmes, 8 Oakdale road, Nether Edge, Sheffield, England. This invention provides valve-controlled connections whereby the steam may, on the completion of its primary function be admitted to and allowed to act expansively in the steam cylinder of the intensifier so as to correspondingly reduce the quantity of steam required in this cylinder

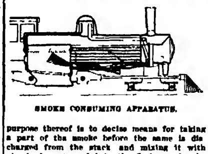
PACKING.—G E Walsot deceased, care of W A Kruger, 16 Newberry St. Providence, R. I. Use is here made of a tubular packing made in sections and encircling the rod or stem, the sections being provided with conical ends, the rings having conical openings engaging the said conical ends for holding the sections together and pressing the same against the rod or stem

Railways and Their Accessories.

APPLIANCE FOR CONTROLLING MOVING TRAINS.—J F Kimaas, Apple Creek Ohio. By means of this device a letter telegram, or order may be held in position to be caught by a trainman on a moving train wherein the inclosure may be so held that there will be no possibility of failure on the part of the trainman to locate the inclosure by day or by night and will release the inclosure as soon as traction is made thereon

METALLIC RAILWAY TIE AND RAIL FASTENING THEREFOR.—M J Shannon, care of A G Kerns, Wallace Idaho. This invention is an improvement in metallic ties and devices adapted to support rails thereon and to secure the supports and rails themselves thereto. Means provide for the introduction of a wedge to raise a block becoming lowered by wear, also to compensate for compression and wear of the cushion plate. The latter may be made of paper and will deaden sound and prolong the life of the rails

SMOKE CONSUMING APPARATUS.—H N Martin Chichester and Morris Aves. Morris Park L. I N Y. This apparatus is designed to be applied preferably to locomotives and traction engines in general, and the



SMOKE CONSUMING APPARATUS.

purpose thereof is to devise means for taking a part of the smoke before the same is discharged from the stack and mixing it with air, to be returned into the firebox, whereby all the particles of carbon and other inflammable substances suspended in the smoke and other gases, can be completely consumed before the smoke is discharged through the stack into the surrounding atmosphere. In the engraving a longitudinal sectional view of a locomotive is shown to which the smoke consuming apparatus is applied

RAIL.—H Collins 69 East 87th St. Manhattan New York, N. Y. The invention relates more particularly to rails such as are used in streets and flanked by the pavement with

RAILROAD RAIL.

only the heads visible. The invention provides a rail arranged to permit convenient removal of a worn out rail head and replacing the same by a new one without disturbing the position of the remainder of the rail on the ties and without requiring tearing up all of the pavement flanking the rail, thus saving considerable expense on rails and time and labor in replacing worn out heads by new ones. For this purpose use is made of a rail head seat, a removable rail head seated on said seat, and wedges for wedging the rail head in place on the seat. The engraving shows a transverse section of the rail.

BLOCK SIGNAL SYSTEM.—W A Lacer, 8010 Constance Ave., Chicago, Ill. By the use of this electrically-operated mechanism a semaphore arm, or analogous member, may be caused to assume a number of separate positions under the automatic control of the rolling stock, and after the signalling members is once set in any of its positions by aid of an electric current, no further current is used in holding it in such positions.

RAILROAD TIE AND RAIL FASTENER.—F C Shaman, 8 Academy Place, Oneonta, N Y. The intention here is to provide certain new and useful improvements in railroad ties and rail fasteners whereby the ties are rendered practically indestructible and the rails are securely held in place to prevent the same from spreading.

EXTENSION DEVICE FOR CAR PLATFORMS.—K L. Elsner, 882 Union St., Brooklyn, N Y. The object in this case is to attach to the ends of the car adjacent the doorway a device which can be connected to move in unison with the door to bridge the space between the car and the platform as soon as the door is opened and thus eliminate all risk of accident and injury

Pertaining to Vehicles.

HEADLIGHT.—E L. Wicarty, care of L. D Kirkpatrick, 7 and 8 Mercer Bldg Aledo, Ill. In this case it is sought to provide the light on the frame of the car in such manner as to permit the adjustment of the light to cast its rays either straight forward or at any desired angle either to the right or to the left, whether the car is moving or still.

TIRE INFLATER.—W A Vinson R. 5 No. 44 Vancouver Wash. An object of this inventor is to provide a simple and efficient tire inflater adapted to be operated by the motor of an automobile or the like and serving automatically to maintain the pneumatic tires of the vehicle inflated at a predetermined pressure

MOTOR VEHICLE DRIVING GEAR.—J A Schaaf, Richwood, Ohio. This invention provides a mechanism employing a plurality of driving friction disks and plurality of movable transmission wheels operatively engaged therewith, means for shifting the wheels to engage and disengage the disks in planes perpendicular to the disks whereby extreme width of the friction surface of the wheels is made effective, provides mechanism for shifting the disks by varying the speed of transmission and for discontinuing the same and provides for varying the speed of transmission mechanism on opposite sides of the vehicle to produce an effect similar to that obtained when employing a differential mechanism while following a curved path.

SANDING DEVICE FOR AUTOMOBILES.—L W Samuels, 585 W 113th St Manhattan, New York N Y. In this device for automobiles and similar vehicles a hollow mud guard is utilized as a sand receptacle and is provided with means for controlling the discharge of sand upon the periphery of the wheels for the purpose of preventing skidding

Designs.

DESIGN FOR A PENHOLDER OR SIMILAR ARTICLE.—M Bernstein 3607 Broadway New York N Y. In this design for a pen holder, the handle is gourd shaped in beautiful lines and ornamentally scrolled at the larger end. A chain hangs from the article, and at the small end of the latter a pen is inserted.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee title of the invention, and date of this paper

INQUIRY COLUMN

Inquiry No. 9286. Wanted household novelties or business necessities which can be retailed at from $1 to $3.

Inquiry No. 9287 Wanted to buy a machine which will reduce cobs to meal—not a machine for shredding the cobs, but a machine that will pulverize them.

Inquiry No. 9288 Wanted the names and addresses of concerns that can coat steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9289 Wanted substance melting at 212° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oily or fatty vapor

Inquiry No. 9290. Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes, namely, to fold up bills and insert them with other coins in a pay envelope of the usual size.

Inquiry No. 9291. Want to buy machinery for manufacturing wooden tooth picks.

Inquiry No. 9292. Wanted a gum that will stick labels to grape-fruit.

Inquiry No. 9293. Wanted the names and addresses of manufacturers of waterproof cloth [illegible]

Inquiry No. 9294. Wanted to buy [illegible]

A Parcels Post Tunnel Railway

(Concluded from page 5.)

gears to an electric motor mounted on the front end of the car At the rear end there is a small trolley pole with a T shaped head, which bears upward against the under side of the conductor rail. A reversing switch for changing the direction of motion of the car is located close to the trolley A direct current of 230 volts is used in the propulsion of the car, the current going out through the conductor rail and returning by the central track rail. In order to isolate the electric circuit and to give a direct current of desired voltage the power is supplied by a motor generator The small car can be driven at almost any reasonable speed, since there is no tendency to leave the track in turning sharp curves, but it is believed that in service a speed of 20 miles per hour will be found most practicable. If an ordinary two-rail track were employed instead of the three-rail construction described, it would be impossible to give sufficient super-elevation of the outer rail on the curves of so short a radius to keep the car on the track at maximum speed, but with the three rails the outward thrust due to centrifugal force is taken by the outer guide rail, and there is no component tending to derail the car Cars can be dispatched singly or coupled in trains.

In the station the conductor rail is placed at the side of the track, and is connected to the generator through a resistance which gives the car a low velocity To move the car in the station the operator pulls a hand lever that throws a contactor out against this side rail, but on releasing the lever the contactor is drawn away from the rail by a spring, so that the car continues its movement only so long as the operator holds the contactor on the rail This makes it possible to easily move the car about in the station. The car is dispatched by running it into the tunnel far enough for the trolley to make contact with the overhead conductor rail, then it is propelled automatically along the line until it arrives at the station, where the trolley leaves the conductor rail, cutting off the supply of current to the motor The car is brought to rest by sliding on wooden skids which are laid on each side of the center rail Underneath the car are two wooden faced shoes, which are made to bear upon the skids by a slight depression in the center rail. This is similar to the method employed in stopping the cars of "roller coasters" seen at amusement parks, but differs somewhat in detail The car slides along the skids for a distance of 30 or 40 feet, coming gradually to rest without shock As soon as it stops, by lifting a handle the shoes are unlocked and allowed to swing upward, which permits the car to rest on the track again, and then it can be moved forward out of the way of the following car Cars can be run at intervals of half a minute, and they are prevented from overtaking one another by the use of constant speed motors. As the speed of each car is practically the same throughout its travel, regardless of curves or grades, a nearly constant distance is maintained between them. Experiments show that in descending the 5 per cent grade which leads into the station at the demonstration plant, the motor on the car becomes a generator and returns power to the line. This has the effect of a brake on the car and prevents excessive speed on down grades. In ascending the 5 per cent grade, no appreciable diminution in speed is noticed.

Where several stations are located along a line, automatic switching devices can be provided whereby cars can be made to stop at any predetermined station Such switching devices are not shown at the demonstration plant.

A series of careful experiments have been conducted to obtain data useful in designing future installations. A chronograph has been used to determine accurately the speed of the car at each point as it travels around the circuit. Contactors that close an electric circuit through the chronograph when the wheels

of the car pass over them are located at intervals of 20 feet along the track, thus recording the time of passage of the car over each 20-foot section of track. Half second intervals are also recorded on the chronograph by connection through the pendulum of a clock The power consumed by the motor on the car is registered by a recording wattmeter, the chart of which makes one revolution while the car makes the circuit of the track. An electrically controlled pen in the time circuit of the chronograph records half second intervals on the edge of the chart. Thus the records of the chronograph and the wattmeter are co-ordinated. Air resistances in the tunnel are measured by a photographic recording water column.

Progress of the Weather Bureau

THE annual report of the Chief of the Weather Bureau, just published, covering the fiscal year ended June 30th, 1912, while containing nothing of sensational interest, is a record of substantial progress in the meteorological work of the Government The following items are especially worthy of notice

As usual, the work of the Mount Weather Observatory heads the report The scope of this institution has been somewhat enlarged, as it now serves as a school of instruction for newly appointed observers, who spend a few months here before being assigned to stations in the field. For five years past the observatory has been making daily observations of the upper air with kites and captive balloons, in all kinds of weather The results of these observations, telegraphed to Washington, are sometimes highly useful to the forecaster at other times less so, hence the plan of making daily flights has been discontinued, and hereafter flights will be made only when there is a type of weather above the station that it is desired to explore. During the year three series of continuous kite flights were made for periods of 24 hours each, in order to obtain information concerning the diurnal variation of temperature at various altitudes in the free air The Bureau has published a valuable digest of all the sounding balloon observations heretofore made in this country, viz., 70 made by the Mount Weather staff at certain places in the West, and 59 made by the staff of the Blue Hill Observatory Studies on the relation between the temperature on mountain tops and that of adjacent valleys have been continued. These have a practical bearing on the question of air drainage and its effects on fruit in the valleys.

Perhaps the greatest desideratum in meteorology is more knowledge concerning radiation from sun, sky and earth, and the Weather Bureau is doing its part toward supplying this need The radiation received from sun and sky upon a horizontal surface is measured at Mount Weather by means of a horizontally exposed Callendar pyrheliometer Direct solar radiation is measured with the pyrheliometers of Marvin, Angström, Callendar and Abbot, and polarization of sky light is observed with the Pickering polarimeter and the Savart polariscope. The observations of polarization are employed in the study of atmospheric transmissibility, which not only varies with the weather from day to day, but also from year to year on account of causes not yet understood. All this is in line with the world wide efforts that are being made to find out how much energy we receive from the sun, how the amount varies, and how this energy is disposed of by the atmosphere and terrestrial objects. On the answer to these questions depends the explanation of the principal mechanical phenomena of the atmosphere.

The Weather Bureau is co-operating with the University of Pittsburgh in the study of the smoke problem, which of course has meteorological bearings. Several contributions to pure science have been made during the year by the physicist of the Bureau, Prof. W J Humphreys, the most noteworthy being his explanation of the double diurnal fluctuation of the barometer.

The dream of the weather forecaster is to have at his disposal daily synchronous charts of the meteorological conditions over the whole world. Year by year the realization of this ideal is being approached. The chart of the northern hemisphere drawn every morning in Washington has recently been made more complete by the addition of reports from Dutch Harbor, in the Aleutian Islands, Nemuro, Japan, Shanghai, China, and several stations in Asiatic Russia. Now the great question is to bring the oceanic areas into the field by means of wireless reports from vessels, and the most important step in this direction has been achieved through the efforts of the Chief of the Weather Bureau, who as a delegate to the London Radiotelegraphic Conference last summer induced that body to agree to a regulation giving weather reports priority over all other wireless messages except distress calls. The Weather Bureau has already framed a tentative plan for a weather service covering the North Atlantic Ocean, and this will doubtless be put into effect as soon as European co-operation can be secured. In waters adjacent to the United States an effective wireless weather service is already in operation

Other projects under way include an investigation of the mysterious "thermal belts" or "frostless zones" of the Blue Ridge Mountains, experiments with devices for frost protection, especially various coverings, which it is thought may be used not only for fruit trees, but also for vegetables and alfalfa, and, last but not least, a thorough experimental investigation of the errors of anemometers at high wind velocities.

The Respiration Calorimeter

ONE of the most efficient mechanical aids to the investigator of the changes which take place when a chemical substance or a plant or an animal is observed under controlled conditions is the respiration calorimeter of the Department of Agriculture

The first report of experiments with the respiration calorimeter was published in 1897, during the first year of Secretary Wilson's administration. Since that time numerous bulletins and other papers have appeared which have described the apparatus, noted very important modifications and reported the results of investigations. As time has progressed, the apparatus as originally devised has been greatly simplified and made easier of operation, and so developed that more factors can be determined than was the case at first.

The respiration calorimeter was designed and has been used for the study of problems concerned with the food and nutrition of man and animal, the value of different foods as sources of energy for muscular work, and other similar questions. It has recently been adapted to the study of fruit-ripening and other problems of vegetable physiology, and is equally useful for the study of a great variety of other problems, as for instance, questions of ventilation of houses and farm buildings.

The experiments with the respiration calorimeter have furnished new facts and figures of great importance to students regarding the processes of respiration and accurate information regarding the energy which man needs to run his body machine and the effects upon his energy requirements of sleeping and waking, rest and work, and other factors. It is now possible to discuss such questions on the basis of accurate measurements, and this was not hitherto the case. The question of the energy which man expends to digest and assimilate his food has also been studied.

A deduction of great theoretical interest obtained with the respiration calorimeter experiments is that the law of conservation of energy holds in the animal body. Such a conclusion is at the basis of many important deductions regarding rations and diets and the use which man makes of his food and farm animals make of feeding stuffs.

The human body is a complex machine,

It is important to know its efficiency as compared with other machines. Experiments with the respiration calorimeter show this to be 20 per cent that is, 5 units of energy must be supplied by the food to provide one unit of work. In this respect man compares favorably with the best steam engine, their efficiency, it is safe to say, not exceeding 14 per cent.

Whether or not physical energy must be expended for mental work as well as for muscular work is a question of interest. Judged by the results of a long series of experiments with the respiration calorimeter, severe mental work does not make demands for physical energy, at least in amounts that were measurable even with so accurate an instrument.

It is natural that an apparatus of this character should be used in the study of technical questions which cannot be approached by simpler means, and in part the results referred to above are technical. However, the usefulness of the respiration calorimeter is not limited to such matters, and it has been of great value in studying questions of everyday interest pertaining to food and the use which man makes of it. It is, in a large measure due to this and related work that we are able to discuss such matters to-day with reasonable certainty.

The feeding standard is something which the farmer of to-day realizes is necessary for success, and a progressive farmer bases his practice on the feeding standards which experimenters have provided for him. If we are to make the right use of our available food supply dietary standards are needed, and those proposed by the Department of Agriculture have had wide use. The proof of the accuracy, with respect to energy, of these dietary standards, has been obtained from experiments with the respiration calorimeter.

The discovery that the respiration calorimeter is equally as valuable for studying ripening fruit processes and other problems of vegetable life and for the study of man's food and the way to use it, has opened up a new line of work. With the apparatus which has been built for this purpose and the larger respiration calorimeter for experiments with man, the Department is in a position to continue its investigations of technical and practical problems and to accumulate very useful and valuable information. The first stage in a valuable kind of work has long been passed, the apparatus and methods have been perfected, and facts of great value have been secured. New fields of usefulness are being entered upon, and the outlook for rapid accumulation of additional data of great importance to all who are interested in the profitable and proper use of agricultural products is assured.

How the Wind Carries Pebbles of Large Size

It has been proved that a wind having a velocity of 23 meters per second is capable of transporting through the air particles of sand only when they do not exceed 2 millimeters in diameter. Yet occasional "rains of stones" of much larger size are occasionally observed. Thus, there is a record of the fall of stones in the Canton de Vaud having diameters ranging as high as 1½ centimeters and of weights up to 2.62 grammes. The nearest region whence they could have come was Maures and Esterel. The case is known also in Château Landon of small calcareous stones of 3 centimeters diameter being carried 150 kilometers.

In Sweden in 1883 stones as large as filberts, enveloped in large ovoid hail stones and weighing nearly 6 grammes, were carried 60 kilometers.

M. Thoulet discusses such cases in *Les Annales de l'Institut Océanographique* and suggests a plausible explanation. He thinks we must accept the idea of some sort of fixation around the pebbles of an envelope of air or vapor of water. The density of the body transported would cease to be that of the pebble, and become that of a mass of combined solid and fluid (or gaseous) matter, which would be sensibly lighter with respect to its volume

NEW BOOKS, ETC.

CHEMICAL RESEARCH IN ITS BEARINGS ON NATIONAL WELFARE. London Society for Promoting Christian Knowledge, 1912. Price, 50 cents.

The major portion of this little book is the lecture delivered by Prof Fischer before the Kaiser Wilhelm Society It gives a very interesting glimpse of the achievements in chemical research which have made Germany one of the most important manufacturing nations in the world.

LUFTSCHRAUBEN Leitfaden fuer den Bau und die Behandlung von Propellern. Von Paul Bejeuhr Mit über 90 Textabbildungen. Frankfurt a. M Verlag von Franz Benjamin Auffarth 1912.

The author of this book assures us that it was written as a result of practical experience for practical men It presents no new theories, but on the other hand it discusses clearly and fully the prevalent views on propeller construction and action with the object of so familiarizing the reader with the subject that when a new theory does come forth, he will be able to judge it critically Starting with a few elementary principles, the author discusses the methods of such men as Wellner Ferber Eberhardt Lanchester etc He explains how propellers are tested by various machines. He leads the reader by the hand through a propeller factory and shows him how the best aeroplane and airship propellers of the day are constructed. The book concludes with a compilation of the most important formulæ.

BAU UND BETRIEB VON PRALL-LUFTSCHIFFEN Von Richard Basenach, Ingenieur in Berlin I Teil Frankfurt a. M Verlag von Franz Benjamin Auffarth, 1912.

It is the author s intention to discuss the subject of the dirigible airship in three parts. This is the first As might be expected it is devoted to a clear discussion of fundamental principles. The second and third parts we are promised will enter more in detail into the niceties of construction and operation In this first part, the author has presented an account of the underlying principles of the dirigible airship which must be read with lively interest not only by the layman but even by the professional builder of airships. It is not often that we find expert information delivered so lucidly and so instructively

ADDRESSES TO ENGINEERING STUDENTS. Kansas City, Missouri Waddell & Harrington, 1912 8vo, 563 pp Price, $1

Some time ago we made favorable mention of this collection of papers Within three months of the issue of the first edition of three thousand copies the supply was exhausted and a second edition made necessary Its present form includes five additional papers of special importance and as the work is not a money-making venture but a true effort to place before engineering students and practicing engineers a series of papers by the greatest authorities, that shall prove a help and an inspiration the success of the enterprise to date is encouraging and its continued appeal is a foregone conclusion.

EFFECTS OF ERRORS IN SURVEYING. By Henry Briggs, M Sc Philadelphia J B Lippincott Company, 1912. 12mo., 179 pp, illustrated

The theory of errors a branch of the theory of probabilities, owes its development to the labors of Gauss while Bessel, following him gave to the world valuable methods for distributing errors in triangulation and was also the first to apply these processes to trigonometrical surveys There are a number of good text-books in existence dealing with the application of the law of the least squares to triangulation but comparatively little progress has been made in investigation of the propagation of error in surveys Hence the work in hand is a welcome contribution to the study of errors and their combination as they may affect the accuracy of surveys. Rules are formulated against the occurrence of such errors and methods are devised whereby the mistake likely to occur in any given case may be properly accounted for, and taken care of The criterion known as the average error' has been adopted instead of that of the 'probable error In this the author is following sound precedent if not common usage, and he has at least easier computation on his side of the argument. Throughout, the treatment is frankly mathematical and the reader s familiarity with the elementary branches of the subject is taken for granted

THE GASOLINE AUTOMOBILE A Practical Discussion of the Development and Present Status of the Automobile. By Victor Lougheed and Morris A. Hall. Chicago American School of Correspondence, 1912. 8vo., 307 pp., illustrated Price, $2.

CARE AND OPERATION OF AUTOMOBILES. A Handbook on Driving, Road Troubles and Home Repairs. By Morris A. Hall. Chicago American School of Correspondence 1912 8vo., 140 pp., illustrated Price, $1

The two works are uniform in style and binding and constitute a helpful contribution, albeit in an already somewhat crowded field. Disclaiming "The Gasoline Automobile" as in any way exhaustive, the publishers have designed it to meet a need for a reliable, readable presentation of the elements of the gasoline motor and its accessories, with a discussion of the newer features of the modern car. Illustration has not been spared, and the aims of the publishers have been adequately carried out by the authors. In the 'Care and Operation of Automobiles," is presented as a separate volume the latter part of the first work In other words, there is practically nothing in the 'Care and Operation of Automobiles' that is not included in "The Gasoline Automobile. It simply allows those who want the practical suggestions on care and operation, and do not wish to study development and present status to get these suggestions in separate binding This should be distinctly understood The information concerning private garages and repairs is timely and gives some very good pictures showing exterior appearance and interior arrangement. A list of the necessary tool equipment and its cost is given, with many home-made devices and conveniences, and clear instruction in the use of tools and the carrying on of repairs at home. By following these suggestions and directions, much of the expense of public garage repairing may be avoided, and the owner acquires a knowledge of his car and of repairs methods in general that cannot fail to be of the highest service to him on the road.

THE MODERN LOCOMOTIVE. By C Edgar Allen. New York G P Putnam's Sons, 1912 16mo, 174 pp, illustrated. Price, 40 cents net.

As one of the Cambridge Manuals of Science and Literature, this little primer upholds the reputation of the series. Within its narrow confines is packed an astonishing amount of information regarding the design and working of the modern locomotive—the generation of its steam combustion and vaporization, superheating, and traction effort. Frames and running gear stability performances and speeds—all are popularly but efficiently discussed and glimpses are given into the wonderful methods and achievements of the locomotive shop.

RUBBER TRADE DIRECTORY OF THE WORLD, 1912 New York The India Rubber Publishing Company 8vo, 313 pp. Price, $3 50.

This directory is issued under geographical divisions covering the United States and Canada, Central America, South America, Europe, Asia Africa and Australia These major divisions each include minor divisions which classify rubber goods factories, rubber planting companies, rubber and waste dealers, manufacturers of compounding ingredients, of rubber machinery etc. In short the directory has been vastly enlarged in scope since its first appearance in 1908 In the plantation list, it cites only those companies that are on an established basis. Yet we find listed no less than 132 rubber plantations with offices in the United States and Canada. Many influences have been at work during the past few years tending to unify the various branches of the rubber industry and the factory end of the industry no longer lacks interest in the planting and cultivation of the product The directory will doubtless be put to extensive use by manufacturers, importers reclaimers waste dealers, and planting companies.

FIRE PREVENTION A Treatise and Textbook on Making Life and Property Safe Against Fire By Peter Joseph McKeon. New York The Chief Publishing Company, 1912 Price, $1 75

An expert has here dealt with the reduction of fire prevention to a science giving the reader a very full and complete set of instructions for the prevention and control of fires. He addresses himself to the owner and the occupant and urges their co-operation with the department by making the buildings safe against fire by removing dangerous material by an adequate equipment of water pails, chemical extinguishers, standpipes, and automatic extinguishers by automatic alarms and watchman service by special signal calling the firemen direct to the building by localizing the fire by means of brick-inclosed stairways and elevators by seeing that stairs, elevators, and escapes are readily accessible and by the establishment of the fire drill. The material is well arranged the various safeguards clearly illustrated, and the arguments sound The work may be recommended to business men, superintendents, janitors, householders, and the general public

MOULDING CONCRETE FLOWER POTS, BOXES, JARDINIERES, ETC By A A. Houghton, New York The Norman W Henley Publishing Company, 1912.

MOULDING CONCRETE FOUNTAINS AND LAWN ORNAMENTS. By A A. Houghton. New York The Norman W Henley Publishing Company, 1912

These two little volumes are respectively No. 10 and 11 of a series of concrete workers' reference books. Both give helpful, practical suggestions for manipulating cement for the purposes indicated by the titles of the books. Any man who is reasonably skillful with his hands ought to be able to follow the suggestions given in these volumes.

LES RAVAGEURS. Récits sur les insectes nuisibles à l'agriculture. Par J.-H. Fabre, correspondant de l'Institut. Un vol. in-18, illustré de 16 planches hors-texte en photogravure. Paris Librairie Ch. Delagrave, 1912.

M Fabre has made an international reputation for himself as a scientist who knows how to present the facts of entomology in a popular and readable way The denizens of the garden, the meadow and the field are here described with a literary charm that commands admiration. The book is written in dialogue form, which has the advantage of injecting the human element into the discussion.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12723) F C De M asks Can you advise process of staining or coloring sheet aluminium a dead black? A A formula for blackening aluminium is as follows White arsenic, 1 ounce sulphate of iron 1 ounce hydrochloric acid 12 ounces water 12 ounces. Dissolve the iron and arsenic in the acid and add the water Clean the aluminium thoroughly with fine emery powder and wash before immersing it in the blackening solution When the blackening is deep enough dry off with fine sawdust and lacquer

(12724) R C J asks Some time ago the SCIENTIFIC AMERICAN contained an account of how a high-votage line had broken and how the current passed across a plowed field fusing the soil into a hard mass. Why not use this idea in the construction of roads? How much current would you need to fuse the earth three inches deep? A We are not able to answer your question as to making a road by the fusion of the earth by an electric current The accidental fusion of a line across a field is a very different matter from the making of a roadbed wide and deep enough to serve for traffic. The cost even where electricity is very cheap would certainly be very heavy

(12725) D M writes According to the scientists investigations show that the Aurora is no doubt due to streams of electric corpuscles which are thrown off from the sun during sunspot activities and repelled by the repulsive force of light at immense velocities in all directions from that orb and that when the earth encounters such streams they are drawn toward the magnetic poles where they recompose or condense as it were, producing the beautiful auroral light.

The strange feature of the case is that in all the active displays which I have observed the motion of the light is always upward, for one will see a brilliant patch of light start at the bottom of the curtain or streamer and shoot upward with a tremendous speed giving one the idea that such electricity was being discharged away from the earth and not being received, for under such conditions the light would appear, I should think as falling toward the earth.

Again if such electrical energy was being drawn toward the earth why does not the Aurora touch the earth within the immediate vicinity of the magnetic poles? From recent observations the altitude of the Aurora varies from within a few miles to eighty or more while in some of the earlier works on the subject a curtain was observed to be only a few hundred feet above the ground while rays have been seen to apparently touch the ground in Arctic regions but perhaps this was the effect of mirage Weather Bureau kites and captive balloons have, I understand reached an altitude of ten miles Now do you not think they would be of some value in determining condition of temperature pressure humidity and electrical state of the atmosphere if sent up during an aurora? For as before stated such displays especially in the zone of maximum frequency which passes through Norway etc occur at no very great height If such calculations are correct a kite or balloon could be sent right into the heart of the Aurora's mysterious glow and much might be gained. I should like very much to know more about this interesting phenomena and what some of your readers might have to say A The occurrence of magnetic disturbances simultaneously with auroral displays and the fact that auroral streamers coincide as nearly as we can tell with lines of magnetic force are two good reasons but not the only ones, for believing that the auroras themselves are of electrical origin But it is not yet certain that this origin is the bombardment of the outer atmosphere by streams of solar electrons. Indeed recent calculations by Prof Schuster show that even if a stream of electrons should leave the sun their mutual repulsion would completely dissipate them before they possibly could reach the earth However as Schuster says, there conceivably may be solar streams of non-electrified particles that somehow or other excite auroral activity but this is mere speculation The electrical nature of auroras is fully conceded but what it is that excites them to activity is not definitely known Auroral streamers *appear* to shoot upward not because of the direction of the discharge, which, like lightning is far too fast to follow but because of growth and increased intensity With decrease of intensity they often appear to drop back but this too gives no indication of the direction of the electrical discharge. Just why there is an auroral ring around each terrestrial magnetic pole inside of which auroras are seldom seen, is not yet a settled question. It has been extensively discussed but not fully solved. As suggested kites and balloons might be sent up at the time of an auroral discharge, but there is no good reason to expect the gain in this way of much additional knowledge about auroras. Kites seldom reach an elevation greater than four miles, nor captive balloons more than two miles, while the region of the auroral discharge appears (nearly always) to be thirty miles and more. Sounding balloons have in rare instances, gone to an elevation of 18 miles. This is far short of the main auroral level.

Sixty-Ninth Year

SCIENTIFIC AMERICAN *for* 1913

AS WE go to press for the first issue of the 69th year of the Scientific American we should like to be able to publish an approximate table of its contents for 1913 Although this may be possible for some journals, with the Scientific American it is obviously out of the question As stated at the head of our editorial colums "The purpose of this journal is to record accurately, simply and interestingly the world s progress in scientific knowledge and industrial achievements " Scientific knowledge and industrial achievements are undergoing phenomenal developments, the progress of which will be chronicled in these pages But what these developments will be who can foretell? So, in forecasting the Scientific American of 1913 we can only refer back to the year just past as an index of the manner in which the subjects for the coming year will be treated, and as a measure of our own development, we invite comparison between the Scientific American for 1912 and that for 1911

Although a table of contents is now out of question, we are able to announce a series of subjects that will come in for special attention These will appear in special magazine numbers which will be continued this year, as they have been in the past two years The list of subjects is indicative of the broad scope of the paper, which concerns itself on the one hand with the vast powers of nature, and on the other with the minute micro-organisms of bacteriology, the great agricultural operations made possible with modern machinery

In the following list of magazine numbers it should be understood that the subjects given out will not monopolize the whole of the number, but each number will contain the same variety of subjects as do the regular issues of the Scientific American

Motor Number
JANUARY 11

NEXT week the Scientific American publishes its fifteenth annual motor number This unlike the other magazine numbers will be wholly devoted to the subject of the automobile and the motor truck Topics of special articles are Automobile Bodies, Past Present and Future Partnership Ownership of a Car Kerosene Engine Carbureters and Convertors How to Realize Economy with a Motor Wagon Left side Steering and Central Control and the Capabilities of the Motor Truck and the Horse Compared There will also be a valuable table classifying all American made cars according to price, showing what cars can be bought for $500 $1 000 $1 500 etc

Agriculture
FEBRUARY 1

FOLLOWING our practice of the last two years the February number will take up the subject of agriculture giving the latest information on improved agricultural machinery and the scientific treatment of soils

Water Supply
MARCH 1

THE tallest building in New York towers 750 feet above the ground—the deepest hole sinks as far below ground giving access to the Acqueduct Tunnel under the East River Although the acqueduct has been described from time to time in the Scientific American it is hard to give an adequate idea of the greatness of this engineering undertaking In our March issue a general survey of the whole aqueduct will be given

Harnessing Nature
APRIL 5

COAL will not last forever What shall we do when it is gone? Of the great powers of nature we have succeeded in harnessing so far only those of the wind and the flowing stream but there are open to us still the enormous power of the waves and the energy that the sun is constantly sending us in the form of light and heat Many efforts have been made to utilize wave power but so far with little success. Just what has been done will be fully explained in the April issue Also there will be an article on the utilization of sun power in which line some very promising experiments have been made

Safety in Travel
MAY 3

IT is time for radical improvements in the conduct of railroads It is time that the automatic stop for trains was adopted not to relieve the engineer of responsibility but to act as a check upon him and to come into operation only in case of a lapse on his part.

Bacteriology
JUNE 7

THIS issue is taken up with the greatness of the infinitely small It will explain how some micro-organisms are our enemies and others our friends and how we may make alliance with the latter to war upon the former

Compressed Air
JULY 5

NOT a steel building not a bridge not a tunnel of any description has been built in this city without the use of compressed air Why should this power be used in place of electricity? The advantages of compressed air and the peculiar conditions requiring its use will be explained in the July issue

Electric Furnace
AUGUST 2

IN this issue we shall deal with the electric furnace as used not in the manufacture of steel but in the laboratory where the intense heat it furnishes permits of chemical operations that enable us to reproduce artificially nature s own work in manufacturing diamonds, precious stones and other valuable products.

Waterways
SEPTEMBER 6

IN this number we are reminded that we must not be so engrossed in the Panama Canal as to forget the important waterways in our own immediate neighborhood The Cape Cod Canal the Canadian canals, harbor improvements the widening and deepening of our navigable streams etc

Paper—Its Use in the Arts
OCTOBER 4

THE subject which is to be taken up in this issue is full of great interest Not many realize to what extent paper and wood pulp enter into the arts, to suggest the various uses here would be to spoil the coming story

Great Inventions of Our Time
NOVEMBER 1

ALTHOUGH all important inventions are described in the Scientific American there are some that stand out above the rest and that are of an epoch-making character These will come in for particular attention in the November issue

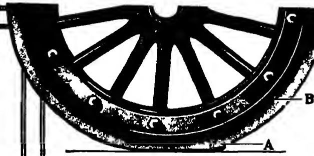
Panama-Pacific Exposition
DECEMBER 6

THE last magazine number of the year will be devoted to the Panama-Pacific Exposition and the opening of the Panama Canal to active service, which will mark a new commercial era for the United States.

The subjects referred to in the magazine numbers will be written by specialists in their several departments. Although we have made special detailed reference to these numbers it must not be inferred that all the interesting material will appear in them The regular weekly numbers will contain the same variety of matter that they have in the past and we shall by no means follow the policy of saving the best for the magazine numbers.

STUDY the illustrations! They show how you can double the efficiency and profit of your heavy service truck.

The upper cut shows the "traction" wave always formed in the ordinary continuous tire under heavy load. This wave, caused by the bulging of the rubber, works into the base and tears the tire from its fastenings. It can't be avoided in any ordinary way. Then, too, this wave forms a constant hill—the tire is always climbing, retarding progress, reducing power efficiency.



Showing traction wave in ordinary continuous tire (A) indicates where wave forms. (B) indicates base where roll and tread separation occur

Contrast this condition with the profit-making worth of—

Firestone

Continuous Base—Notched Tread

Truck Tires

The lower cut shows how the Firestone Notched Tread overcomes the wave, by preventing its formation This is *not* an individual block tire, with tread-tearing, metal-retaining plates The Firestone continuous base is of the same tough, resilient compound as the tread These tires hold the road, increase traction, absorb all vibration

Get the full facts. They mean Economy and Increased Profits

Firestone Truck Tires for Every Type of Car, Every Load, Every Road Condition

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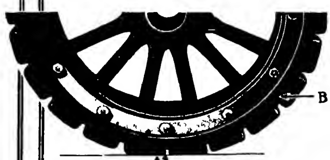


Showing how Firestone Notched Tires overcome destructive traction wave (A) indicates wave passing off into space between blocks. (B) indicates continuous base assuring absorption of vibration in every direction

America's Greatest Touring Cars are Premier Sixes The First of the Five Leading Makers to Establish the New Price Basis for the Six was the Premier

THE public has decided that the high-class car of the future must be a Six. The Premier is one of the four makers whose six-cylinder cars have created this six-cylinder demand. Seven years' production of successful sixes.

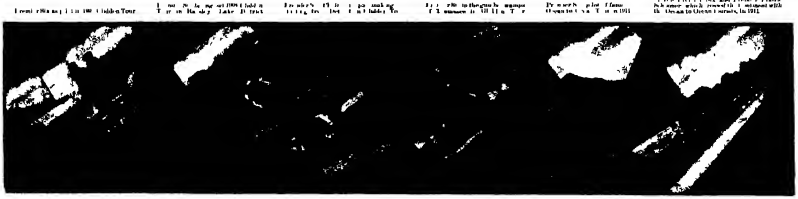
The Premier six-cylinder is not only a leader in price but in style and appointments. It is fitted with pneumatic starter, pneumatic tire inflator, independent electric lighting system, imported magneto, imported annular bearings, left hand drive, clean running boards, a cabinet mounted in the dash providing a tool carrying compartment, gasoline fed by gravity with filling cap accessible without removing the cushions, luxurious upholstering, Turkish cushions, concealed hinges, and straight line bodies finished with the pleasing touches which make for elegance and class.

Premier Sixes, $2735 to $4000

FULL TOURING CAR EQUIPMENT

The Premier has earned its position as one of the leaders among America's leading cars by its wonderful performance and successful showing in the most trying tours and contests each year.

Manufactured by PREMIER MOTOR MFG. CO., Indianapolis



Electricity's Part in the Automobile

Electric Lighting

F Mazda He

Without the application of electricity it is probable that the automobile as we know it today would not be so convenient and safe a means of pleasure, business and travel

The gasoline car is dependent on an electric spark the electric car upon its storage batteries

When lighting up time comes safety is in a large measure due to a dependable lighting system and satisfactory lamps

On all representative cars ***Edison*** Mazda automobile lamps have been adopted as standard Due to the large volume of light given by ***Edison*** Mazda Lamps for comparatively little current, electric generators and batteries were made small and light enough to be incorporated in the equipment of the modern, up to-date car

The General Electric Company was not only the pioneer in the development of automobile lamps, but is t day the largest manufacturer in the world of this type and of every other type of incandescent lamp

This company is in the closest co operation with car builders and makers of electric lighting systems—the result therefore is the most efficient lamp for all conditions of automobile service—the ***Edison*** Mazda This lamp has a strong sturdy filament made from drawn tungsten wire In connection with electric lighting a number of wiring devices are made which facilitate connecting and disconnecting lamps for permanent or portable use The switches which control the lights also bear that hallmark of quality of the largest electrical manufacturer in the world

Three Circuit Snap Switch

Electric Motors and Controllers

It is a real pleasure to step into a luxuriously fitted electric carriage and by the movement of a single lever apply and govern the propelling force Nothing takes the mind from the fullest enjoyment of the ride

Starting out in evening clothes, without a chauffeur, one can be sure of arriving at his destination with certainty and an unruffled temper if the car is equipped with a dependable power plant, furnished by the General Electric Company, such as has been adopted by electric car builders of the United States using more than 65% of all the electric vehicle motors built

Automobile Motor

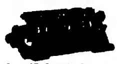
This power plant is so unobtrusive and demands such infrequent inspection or adjustment, that its presence in the vehicle may almost be forgotten

The motor of an electric car must be efficient and light in weight This is to give the greatest possible touring radius on a single battery charge and thus preserve the life of the storage battery, which is dependent upon the number of times it is discharged

Automobile motors made by the General Electric Company meet all these conditions and in addition absolutely prevent over discharge of the battery on steep grades

The electrical design of the motor assures the best operating characteristics as well as embodies many important novel features which have made G-E motors pre eminent in the world's haulage today

The weight of the motors is reduced by the use of aluminum wherever possible and great strength is obtained by making the frame and head of a single piece cylindrical steel casting, machined from end to end



Automobile Controller Continuous Torque Type

The controllers made by the General Electric Company are of the continuous torque type securing smooth acceleration and deceleration under all conditions In both mechanical and electrical design they use the same features which have made G E street car controllers the standard of the world today

Because of the above reasons more than 65% of the electric motor and controller equipment used by automobile manufacturers of the United States is of G-E manufacture

Many merchants who require absolutely dependable delivery service are using in the aggregate hundreds of electric trucks Records show that these trucks are in use more days each year than any other kind of delivery vehicles and that their upkeep is much less

These trucks climb the steepest hills in deep snow or plow through heavy mud with equal ease and certainty

Electric Charging Devices

When Electric Automobiles were first introduced one of the most serious inconveniences connected with their use was to get the batteries charged

This difficulty has been removed by the invention of the Mercury Arc Rectifier, an inexpensive, easily operated device for changing the alternating current of the ordinary lighting circuit to direct current suitable for charging storage batteries With a Rectifier installed in the private garage the car does not have to be sent to the public garage for charging and is always ready for use The General Electric Company makes a small rectifier known as the "Runabout type, which has just the right capacity for charging the batteries of electric pleasure cars

Operating a Runabout Type Mercury Arc Rectifier

When the current supply is from an electric railway circuit, a motor generator set is used in place of a rectifier, but where direct current lighting circuits are available, as in the downtown district of New York City charging rheostats are all that is necessary

In all cases the convenience and usefulness of an electric are greatly increased by reliable equipment for home charging

The foregoing shows the many advantages due to electricity in its application to the automobile

Wherever that silent power called electricity is used, there will be found skilled engineers, backed by the wide resources of the General Electric Company, perfecting the product—making the G E monogram stand for the "guarantee of excellence of goods electrical"

General Electric Company

Largest Electrical Manufacturer in the World
General Office: Schenectady, N Y

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For Texas and Oklahoma business refer to Southwest General Electric Company (formerly Hobson Electric Co)—Dallas, El Paso, Houston and Oklahoma City
For Canadian business refer to Canadian General Electric Company, Ltd, Toronto, Ont

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SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVIII.] NUMBER 2 ★ NEW YORK, JANUARY 11, 1913. ★ [15 CENTS A COPY $3.00 A YEAR

Grueling Tests for Artillery

By Our French Correspondent

THE Krupp establishment is making use of some very efficient endurance or breakdown tests upon artillery, both for keeping up a check upon the standard types of pieces and for testing new designs. One of the most novel methods is the use of a circular electric testing track upon which a car is run in order to draw the artillery pieces over the ground at slow or high speeds as may be required.

At the Essen artillery grounds, which lie near the main factories, there is laid out a circular railroad track with a special kind of electric car running upon it for making the tests upon the artillery. The track has 210 feet mean diameter, which gives it a total length of about 660 feet, being substantially laid on beton and using a single rail on the outer side and a double rail on the inner circle so as to keep the car from running off the track. The railroad track proper is usually reserved for the electric car, while the artillery is run on a circular way which lies on the inside and also on the outside of the main track, thus allowing two pieces to be drawn along at the same time. The artillery track is slightly banked. The railroad track has a 7 foot 6 inch gage, and if desired, the artillery can also be run in the space between the rails. In order to vary the tests the nature of the ground is made different upon various parts of the circular tracks. For instance, some 320 feet of the track, or about half the circle, is laid with a good stone paving, while the remainder represents country roads in more or less good condition. Upon these different stretches of road there can be placed obstacles of various kinds, such as timber lying across the road, ditches or holes and the like. The use of the electric car for drawing the artillery has an advantage from the great number of different running speeds which can be employed, representing what a team of horses would give at a trot or gallop, and much higher speeds can be used when desired.

On the upper floor of a cabin is an inspection room which serves for engineers or official committees when making certain tests upon the artillery, whence the track can be overlooked. Signals can be sent from the track into the cabin in order to give notice to the operators, and for this use there are placed six signal posts around the track so as to send electric bell signals to the cabin during the maneuvers for changing speed or stopping and the like. Across the car is a bar to which the tongue of the artillery piece can be attached so as to run it on the outer, middle or inner track. The car is started up and the piece is taken around at the different speeds which may be required for any given case, so that it will be seen that the electric track allows any such maneuvers to be made very quickly and avoids loss of time. As regards the obstacles which are put in the way of the artillery piece to give it a severe endurance test, one of our engravings shows a field howitzer taking over a heavy piece of round timber and at a high rate of speed. Seeing that the artillery piece springs up to a considerable height and then falls on the ground and that its total weight is 2.4 tons, an idea of the good quality of the axles and wheels will be obtained. Another illustration represents an ammunition wagon being drawn at a high rate by the car and passing over a steep ditch dug on the track at this point. It should be stated that the track is well lighted by arc and incandescent lamps. Up to the present time the tests, which cover a period of several years, amount to as much as 40,000 miles run upon the circular track.

Some very severe tests of another kind are obtained by the use of steam locomotives running on a special stretch of railroad track at the company's artillery grounds at Meppen. At each side of the track is laid out a proving way containing surfaces of varied character or special obstacles. Our engraving shows two artillery pieces attached to a cross bar, each running on a separate way. Here the road is made up of heavy broken stone. When the locomotive is run at high speed this gives a very severe test, and in some cases the artillery pieces jump bodily from the road to a considerable height. This is the case in our present figure, where the obstacles consist of railroad rails laid crosswise and spaced along the way.

Other endurance tests of artillery are made upon actual roads in the country using a team of horses, as one of our photographs shows. The field piece is here passing over a very high obstacle formed of three logs bound together, and it springs a conspicuous height off the road.

Electric motor dragging an ammunition caisson through a hole with steep sides

A test over prepared roadway composed of large stones and boulders.

Recoil siege cannon upon carriage drawn by horses clearing a wooden obstacle at the testing ground of Tangerhütte

Two field guns and their fore-carriages drawn by a steam locomotive over obstacles consisting of railway rails

Testing track at Essen. Field mortar clearing a round log placed across the track

Showing Visitors How Cars Are Made

SOME of the labor-saving devices which were described in a recent issue of the SCIENTIFIC AMERICAN will be shown to the visitors of the New York automobile show in Madison Square Garden. Several typical multiple production machines will be exhibited in operation turning out standard parts in the same manner as it is done in the large automobile factories. This part of the exhibition will probably draw larger crowds than the mere show of the cars, for every one likes to know how the thing is done.

Automobile Accidents in Paris

ACCIDENTS due to automobiles are becoming more frequent in Paris owing to the development of the taxiauto cabs and autobuses. The official figures for last July show a total of 170 accidents during the month, of which the taxicabs are responsible for 59 accidents with 2 deaths. For the autobuses there are 11 accidents with but 1 death. The tramways figure for 20 (6 deaths), and private automobiles make up the remainder. It will thus appear that the autobus is not responsible for as many accidents as might be thought, and the complaints made by the public appear to be unfounded.

The Automobile in Egypt

THE use of automobiles is becoming quite extensive in Egypt within a recent date, especially at Alexandria and Cairo. The latest figures show as many as 563 cars registered at Cairo alone. Even though all of these are not in circulation, it is estimated that at least 400 are in regular use, and these are running almost entirely within the city. Outside of town there are but few roads, such as the Pyramids, Heliopolis and Kubbeh-el-Farag routes. At Alexandria there are counted 167 automobiles. The only good road outside the city is the 8-mile route leading to the resort of San Stefano.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement.

A Century's Decline in American Shipping

THE thirteen original States either bordered on or had easy access to the sea, and the First Congress, recognizing the importance and promise of our maritime interests allowed a rebate of ten per cent of the duty on all goods brought into this country in American vessels. That was in 1789. Under the stimulus of this wise provision our ships multiplied and their enterprising skippers sailed them to the remotest ports of the seven seas. In spite of the British Embargo Act of 1808, matters went so well with our Merchant Marine that in the year 1820 only eight per cent of our foreign commerce was carried in foreign ships. To-day, nearly a century later, the situation has been so completely reversed that only eight per cent of our large and rapidly growing foreign commerce enters the ports of this country under the American flag.

The decadence of our over-sea shipping is due to more than one cause, but there can be no doubt that the first and most vital blow against this industry occurred shortly after the war of 1812, when several reciprocal treaties were made with the leading maritime nations, under which it was agreed to levy the same duty upon American as on foreign ships. In spite of this withdrawal of Government aid, the owners and masters and the excellent crews of that day carried on the competition so successfully that during a period in the middle of the nineteenth century preceding our Civil War the Merchant Marine of the United States took precedence of every other not merely in tonnage, but in the speed and weatherly qualities of its ships and the fine seamanship of the men who sailed them.

It was when our Merchant Marine was at the zenith of its prosperity that two developments of great significance, one political, the other industrial, were in progress which were, ultimately, to sweep our flag from the high seas. The Civil War completely disorganized our deep-sea carrying trade. The sale and transfer of American ships, the depredations of the Confederate cruisers, and the withdrawal of our merchant ships for cruiser and transport service in the South combined to strike a terrible blow against our maritime interests. From this, however, we might have recovered, had it not been for a momentous industrial change, which proved even yet more fatal. This was the coming of the age of iron and steel and the substitution of these materials for wood in the construction of ships, for we were without either the materials or the facilities for steel ship construction. Great Britain, on the other hand, had both. At once, under the altered conditions, that country began to move forward to the absolute supremacy which she has since established; on the other hand, our marine industry, already staggering under the blow dealt by the Civil War, continued steadily to decline. After the war the opening up of the West by the construction of railroads and the development of the vast internal resources of the country, offered so promising a field for capital that a national indifference and neglect was added to the other destructive causes above enumerated. Also the great demand for highly paid labor in the interior of the country robbed the sea of its one-time attraction, and in ever increasing numbers our young men turned from the forecastle to the machine shop and the factory.

Something has been done toward the resuscitation of our shipping by the admission of materials for shipbuilding free of duty, but further measures are necessary. There still remains the great difference in wages and general cost of operation, and something should be done by the Government to offset this. At the present writing it looks as though the needed relief could be found by a return to the successful plan adopted by the First Congress, and allowing a moderate rebate on all goods imported in American bottoms.

The Car of 1913

ALTHOUGH there is a greater difference in automobiles generally this year than there ever was before, it is not of the kind that the average person has as yet come to know or to realize. In other words, it is not so much a difference in lines or appearance—this year's cars will appear much the same as their predecessors—as it is a deeper rooted difference that reveals itself in greater efficiency, greater stamina and greater wearing qualities. The difference between goodness and mediocrity lies now, more than ever, in detail rather than in general.

The use of a better grade of materials, primarily, is responsible for the improvement. The design and construction of present-day cars would seem to indicate that the factor-of-safety bugaboo, which has necessitated comparatively massive construction, to the detriment of car efficiency, has been silenced for all time. True economy, apparent in the use of comparatively expensive vanadium and other alloy steels, rapidly is coming to the fore, and that it has had a beneficial effect in simultaneously reducing weight and increasing strength scarcely can be denied.

Latterly, vanadium has been alloyed with iron for cylinder construction, thereby directly increasing engine efficiency by reducing the ratio of weight to power. It is much the same with copper and aluminum alloys; great strides have been made in metallurgy during the comparatively short space of time embraced in the past twelvemonth, and though it may cause some a pang of regret that progress of the kind is more or less obscure and is not directly convertible into capital through the medium of exhibition, it nevertheless represents the sound foundation upon which reputations are built, and, incidentally, it illuminates the dividing line between the good cars of yesterday and the better cars of to-day.

Design, too, has made strides that are not to be disputed. There is a marked tendency toward the greater rigidity and simplicity attained by the method of casting cylinders in a single block; the integral casting of intake and exhaust gas passages is only one of the plainly visible evidences of successful attempts at better construction. More attention has been paid to the generally recognized necessity for segregating the magneto and the carburetor in order to reduce the hazard of fire, and as a rule ignition apparatus has been more carefully located where it is less exposed to the insidious action of dirt and water.

In the construction of engine components, the careful attention which has been given the lightening and balancing of reciprocating parts has played an important part. Pistons and connecting rods now are considerably lighter than they were. In the majority of factories, crankshafts and even flywheels are carefully balanced, both statically and in the running balance machine which has come into extensive use only within the past year and which has been of recognized value in detecting and directing the correction of faults that result in vibration. Notable advances have been made, also, in the design of valve mechanism, which now is quieter than ever before. Cam shapes remain practically unchanged, though the increasing use of spirally cut gears and silent chains in camshaft driving mechanism has permitted a nearer approach to silence and rendered valve action more positive.

The passing of many city ordinances prohibiting smoke has necessitated the perfection of lubricating systems, and with the perfection automatically has come greater efficiency; oil bills have been cut virtually in halves. The trough system, originally developed for use in Knight type engines, is coming into vogue for poppet valve engines, and auxiliary throttle-controlled systems have been adopted by several prominent manufacturers.

What has been said with regard to the lightening and balancing of engine parts applies with equal force to the clutch. The use of pressed steel parts for cone clutches, which type still appears to be the favorite, has materially lightened the *ensemble* without reducing strength. The lightening, of course, has reduced the tendency to "spin" and in this way has operated to reduce the wear and tear on transmission elements. Spring inserts, which insure against gripping and slipping, are used quite as much as cork inserts, and both are far more popular than they were last year.

Change gear sets have suffered but little alteration in their material aspects. Four forward speeds, however, instead of three, are used to a greater extent than they were, and their advantages no longer are confined to high-priced, or even moderate-priced, cars; several manufacturers whose products list at less than $1,300 have announced four-speed gear sets for the first time this year, thus probably marking the forerunner of their more general adoption for low priced cars. The importance of the metallurgist in the treatment of gear steels is another factor which likely will be realized some years hence, when the gears in 1913 cars are still doing duty and the gears of yesteryear have passed away.

There are just two other things wherein even a casual glance will serve to convey the marked superiority of the 1913 car. The first of these is the noteworthy reduction of rattles and squeaks, which have emanated from brake parts, fenders and springs, and the other is the completeness with which the newer crop of cars is equipped. The former can be attributed only to better construction, and the latter is but the natural outcome of steadily growing demand.

A National Aerodynamic Laboratory

THAT aviation has made the advances it has in this country is very rightly a source of wonderment, because the inventor, the designer, and the builder have all had to grope their way, trusting to incomplete experiments and to empirical formulæ that left much to be desired. Aviation has undoubtedly come to stay, but we have still much to learn before it can be classed with yachting so far as risks are concerned; but fortunately this information can be obtained in a national aerodynamic laboratory without hazard.

The part the model experimental basin has played in the successful evolution of modern ships is a matter of general knowledge. Enormous economies have been effected and the science of naval architecture is advanced. These results have been the substantial return for fairly modest investments. In brief, they have supplanted the rule of thumb and the guesswork of other days. Kindred work is that of the aerodynamic laboratory. A number of European nations have established plants of this sort to their undoubted advantage.

The need of similar facilities in this country has been forcefully urged by Capt. Washington I. Chambers, U. S. N., who is in charge of aviation in our navy. To quote Capt. Chambers:

> "Little more than a year ago our knowledge of the effect of air currents upon aeroplane surfaces was almost entirely a matter of theory. The exact information available was so meager that aeroplanes were built either as copies, slightly modified, of other machines, *or else by way of haphazard experiment*. This state of affairs obtains to some extent in the United States to-day, although in Europe aeroplane construction is now largely based on scientific data obtained at notable aerodynamic laboratories. The intuitive, hasty and crude methods of the pioneer cannot succeed in competition with the accurate and systematic methods of the scientific engineer, and it is beginning to dawn upon our perceptions that through lack of preparation for the work of the scientific engineer, i. e., through delay in establishing an aerodynamic laboratory, a waste of time and money, a decline of prestige and an unnecessary sacrifice of human life have already resulted."

A national aerodynamic laboratory, such as our naval aviation expert recommends, might well be located in Washington, where many established facilities could lend their aid and the rest of the needful plant could be provided at a cost of probably not more than $200,000. Such an institution, presided over by broad-minded men, would be a benefaction to everyone either directly or indirectly interested or concerned in the promotion of aerial navigation.

The work of such a laboratory would logically divide itself into two main divisions: experimental verification, and experimental research. The first would deal essentially with problems as they stand and lead to the formulating of certain standards, but unquestionably the most valuable results would be the fruit of research work prosecuted continuously, systematically, and patiently in the thorough and precise investigation of new ideas or of old ideas with new applications, and in this way discovering general laws and formulæ. In the language of Capt. Chambers this order of procedure "is the short cut to substantial efficiency, economy, improvement, and prestige."

It is not necessary here to mention the apparatus or particular equipment which an aerodynamic laboratory should have. The plant of M. Gustave Eiffel at Auteuil, the trial track at St. Cyr, France, the laboratory of the Italians, the facilities of the Russians at Koutchino, and the splendid German and English institutions show us what we must have. Our own inventive resourcefulness will probably suggest developments. Aviation will mean in the air just what the evolution of the automobile has meant in daily life on the ground, and its adaptations will be quite as varied. Of course, the fighting man is primarily interested in that field, and so is our citizenry, too, because it has already been shown that of two battling countries, the one that has a superior aerial fighting force will surely hold a very great advantage. This is not the prophetic conclusion of the enthusiast, but the actual fact as proved by the results of the Balkan uprising.

Congress saw fit to establish our model experimental basin at the Navy Yard in Washington. Let us trust that the same legislative wisdom will provide a national aerodynamic laboratory. The cost will be modest, but the results will be invaluable.

Electricity

Electrically Operated Suspended Railway.—A novel way of mountain climbing is provided in the new electric suspended railway up the Kohlererberg, in the Tyrolese Mountains. The suspension cables, 5,400 feet in length, are carried on twelve steel supports, and two cars each accommodating fifteen passengers and the driver are operated, one being hauled up the hill by duplicate traction cables while the other is descending. Complete safety appliances are provided, and a magnificent view is opened out as the car rides steadily and smoothly up the 2,760 feet from the Eisack in thirteen minutes.

Picture Telegraphy Across the Atlantic.—Although the Berlin scientist, Dr. Korn, is having good success in sending photographs by wire between stations located at Paris, Berlin and Monte Carlo for use in press work, he wishes to apply his method over a much longer distance. In fact, it is possible to send the photographs by mail between Paris and Berlin, for instance, in a comparatively short time, so that the newspapers are not as likely to take up a picture-transmitting scheme as when they are a long distance from the center of events. For this reason he expects to take up the question of operating upon the Atlantic cable and is confident that he will be able to send photographs across the ocean. He is also considering the matter of coming to America in order to apply the system to a line between New York and San Francisco. We illustrated this apparatus not long ago.

Electric Stage Service Across the Alps.—Quite an extensive project is being organized in Switzerland for an electric automobile service across the Alps, and the cost of improving the roads and purchase of material is about half a million. The line runs from Airolo by way of the Bedretto valley and the Nufnen pass, ending at Ulrichen in the Valais region, with a total length of 25 miles. Considerable work will need to be done in enlarging the routes so as to make them suitable for automobile traffic, and a bridge is to be built over the Tessin River. The new electric automobiles have capacity for 22 passengers and make the trip in 2¼ hours on ordinary and 1¾ on express service, running at 12 to 22 miles an hour. There are eight to ten stations along the route and three trips are made per day in each direction, during all seasons when there is no snow on the roads. A great success is predicted for the electric line.

How a Paris Central Station Gained by the Change to Greenwich Time.—The fact that Paris adopted Greenwich time not long ago causes an electric-light station to gain $20,000 a year, according to an estimate. The reason for this somewhat curious result lies in the difference of time of burning electric lamps and even though this is very small, it figures up in a yearly estimate to quite an extent. Greenwich time of 5 o'clock corresponds to 5.10 Paris time, for instance. Lamps are turned on according to the amount of daylight, but offices close at a fixed hour. Should an office close at 6 o'clock, it is evident that the lamps will have burned 10 minutes longer owing to the change over to Greenwich time. The extra amount of current is naturally paid for by the users, so that this makes the central station gain about 1 per cent, and even this small difference applied to the case of an electric plant furnishing 15,000,000 kilowatts a year, will give the above increase.

Cableway to the Col du Midi.—A suspended cableway is now building on Mont Blanc and it will reach the elevated point of the Col du Midi, which is not far from the summit. It follows somewhat the general lines of the Wetterhorn cableway and like the former it is designed on the Ceretti-Tanfani system. The terminus of the cableway is on the Col du Midi, 11,700 feet high, this being somewhat below the well-known peak of Aiguille du Midi, (12,600 feet), but the latter was rejected in favor of the former owing to lack of space at the peak to make a suitable landing place. The car hangs down from a roller carriage traveling on a single main cable which is stretched along the route upon structural iron towers. There is an upgoing and a downgoing car as in a cable incline, the car being drawn along by a cable working upon sheaves at each end. What is novel is the use of an extra cable running along under the main cable and passing through the carriage. Usually it runs idle, but should the main cable break, it then serves to support the carriage by a set of rollers so as to take the place of the former and the car can still run. Should the towing cable break, on the other hand, the extra cable now serves to draw the car into the station, thus playing a double part in accidents. The line is about 3 miles long in horizontal projection and starts from the Pelerins station at an altitude of 3,400 feet, and ending at the Col du Midi 8,300 feet higher. The lower end lies near Chamonix, and the railroad runs quite near this point. It is laid out in four sections to avoid using too long spans, so that passengers change cars three times. The maximum length of span allowed is 2,300 feet on account of the strain on the towers. The second station is at La Para and the third at Bossons glacier. It is proposed to run an automobile service to bring tourists from Chamonix to the lower station. One section of the cableway is nearly finished and the whole will be running in 1916.

Science

The International Union for Solar Research, which last met on Mt. Wilson, Cal., in 1910, will hold its next meeting at Bonn, beginning August 1st, 1913.

An Oyster-shell Building.—A five-story concrete building, the concrete being made of oyster shell from the reefs of Galveston Bay, has been erected at Galveston, Texas. The owners of the building and its constructors, Nic Bohn and G. Tietze, claim this material is better and cheaper than concrete made with gravel. Shell concrete built into a wall 3 feet high and 336 feet long in 1882 withstood the severe test of fire and water and is to-day as sound as when built. It is estimated that the shells of 5,896,000 oysters are imbedded in the walls of this building. This is said to be the only building of its kind in the world.

The British Association for the Advancement of Science will meet in Australia, for the first time, August 1914. The Association has met three times in Canada, and once in South Africa, but all the other meetings have been held in the British Isles. The Australian meeting will include sessions at several towns. The commonwealth government has appointed a federal council to arrange for the meeting, under the patronage of the governor-general and with the prime minister as chairman, and has granted £15,000 to pay the passage to Australia of not fewer than 150 official representatives. A number of foreign men of science will be included in this number.

Effects of Indol in Producing Symptoms of Senility.—Some interesting experiments as to the effect of the chemical compound indol in producing sclerosis have just been conducted by a pupil of Metchnikoff. Indol is one of the toxins secreted by intestinal bacteria, and Metchnikoff has claimed that it was responsible for certain symptoms of senility. In the experiments referred to doses of 0.04 gram of indol were injected into guinea-pigs. Not only was sclerosis of the aorta observed, but the liver, kidneys, and suprarenals were affected and there was a tendency to hardening of the brain. Since these are all symptoms of age, Metchnikoff's theory seems thus far supported.

The Electrical Resistance of Trees has been made the subject of some elaborate experiments by G. E. Stone and G. H. Chapman at the Massachusetts Agricultural Experiment Station. It was previously known that trees possess relatively high resistance—an important quality as serving to protect them from lightning—and that the resistance varies for different kinds of tissues. Messrs. Stone and Chapman's investigations reveal the further fact that the resistance varies markedly with the temperature, being higher with a low temperature and lower with a high temperature. This fact results in a diurnal and an annual period in the resistance. The cambium layer shows the least electrical resistance. This is followed by the phloem and the sapwood.

Aeronautical Weather Station in England.—The British Meteorological Office has arranged to operate a branch of its service at the Royal Aircraft Factory, South Farnborough, for the purpose of supplying meteorological information and forecasts in a form directly applicable for the guidance of airmen, and also for carrying on investigations of meteorological problems for the Advisory Committee on Aeronautics. Mr. J. S. Dines has been appointed meteorologist in charge. The equipment will include pilot and sounding balloons and laboratory appliances, in addition to the ordinary meteorological apparatus. Special forecasts and warnings for aeronauts will be issued on the basis of information telephoned from the Meteorological Office at South Kensington.

The Economics of Mountain Snowfall.—The attention of American meteorologists has been directed in recent years to the great importance of the winter snowfall in the mountains of semi-arid western states as a source of the water available for agricultural purposes or for motive power the following summer. A dual problem has been under investigation: (1) the development of methods of measuring the volume of snow lying on the mountain slopes, as a means of predicting the amount of water it will yield, and (2) the conservation of the snow by appropriate treatment of the forest cover. Among the interesting discoveries made in this connection is the fact that the ideal forest for snow conservation is one filled with glades whose area bears such proportion to the height of the trees that, while snow enters freely, the wind and sun cannot reach the bottom. The production of such glades by cutting and pruning, as well as by planting trees of suitable species (e. g., the mountain hemlock), becomes, therefore, a part of forest practice in the regions in question. Aside from investigations by the Weather Bureau and other government institutions, this subject has been most actively studied by the excellent meteorological department of the University of Nevada, which is now planning to offer a special course for foresters on the relation of mountains and forests to the conservation of snow. An adjunct of this university is the well-known meteorological observatory on Mount Rose.

Automobile

International Automobile Shows.—International exhibitions of automobiles have been planned [illegible] 11th to 22nd, in Brussels, Belgium, and for the months of March, April and May in Vienna, Turin, Budapesth, St. Petersburg, Berlin and Stockholm.

The Footstool-lunch Basket.—By way of killing two birds with one stone, so to speak, an enterprising accessory manufacturer has developed an automobile lunch basket which serves a dual purpose in that it is a footstool as well. The basket proper is made of wicker-ware and is fitted with the usual knives and forks, cups and saucers, etc., with a liberal space for the storage of food. The top is slanting and strong and is covered with leather to resist wear. It is designed to be placed in the tonneau.

The Deep Cushion.—Just where the deepening of cushions will end, unless it ends on the floor of the car, no man can tell at present. When ten-inch cushions were advertised as the acme of perfection, enterprising manufacturers almost immediately announced twelve-inch upholstery and two more lately have gone to the length of providing cushions no less than fourteen inches in thickness. The saving grace of an otherwise ludicrous situation is that the deepening of cushions in general has had a distinctly beneficial effect—for the car owner, of course.

Guessing at Speeds.—Demonstrating the deceptive nature of speed judging by sight alone, the results of a test recently held by a British automobile club are interesting. Several motorists were lined up on an unfrequented road and required to estimate the speed of a car driven at a predetermined rate with the aid of a speedometer. Out of four trial runs at various speeds only two speeds were guessed by one person correctly. The others varied from the correct speeds to such an extent as to emphasize very forcibly that it is practically impossible, without extensive practice, to judge of the speed of a car merely by watching it pass.

"Clean Design" in Cars.—"There are no kinks, no corners nor gable-end projections at dash or elsewhere," advertises a well-known foreign manufacturer in bringing to public notice his latest creation. Which, briefly, is exactly what the present American car accents. Never before has the striving for "clean design" been so apparent in American products. Unsightly tool boxes which heretofore have cluttered up running boards have been relegated to places of less conspicuousness and the "blending" of lines at dash and at tonneau is a marked contrast to the angles and generally unfinished appearance ushered in with the adoption of front doors.

The Long-stroke Motor.—Imported from abroad, where it flourished long before it got to America, no waning is apparent in the popularity of the long-stroke motor. From a conservative middle ground, manufacturers apparently are getting to the extreme in stroke to bore ratios and the wisdom of the practice well may be doubted. Among the later developments announced for the coming season, are two motors from the same manufacturer, one of which measures $3\frac{3}{8} \times 6$ and the other measures $4\frac{1}{4} \times 7$. It is true that motors with even longer strokes than these have given a measure of success abroad and they therefore cannot be viewed wholly in the light of experiments. Time only, on the road, in the hands of owners, can tell just how much the designer has bettered existing conditions by his plans.

The Filled Tire.—Periodically, almost continuously, the cellular, spongy or gelatinous tire-filling compound which is expected to replace the air in pneumatic tires makes its appearance, floats for a moment in the public eye and then fades away into the future. But it must not necessarily be assumed that such will always be the case and that success in this direction never will be obtained. The repeated resurrection of the idea shows the existence of a latent demand and it is quite within the bounds of possibility that the demand may some day be filled. Already there are several such compounds on the market which are giving a measure of success and in them their manufacturer, or compounders, would seem to have eliminated many of the difficulties which at first were experienced with everything that was supposed to take the place of air and banish tire troubles forever.

Wire Wheels.—Despite the fact that the automobile undoubtedly has reached a noteworthy plane of efficiency and dependability there can be little reason to suspect that finality of design has been reached. There are few manufacturers who have not something new to offer either in the way of equipment or design that has been slightly altered still further to increase efficiency and to reduce the small amount of physical labor necessary in the operation of any car. More than ordinarily prominent among the changes which will be evident in the car of 1913, and which can be listed under the heading "tendency in design," is the widespread movement in favor of wire wheels. Already more than a score of manufacturers have specified wire wheels as optional equipment and three or four have taken the bull by the horns, in a manner of speaking, and have specified wire wheels as standard equipment, with wooden artillery wheels optional.

In outward appearance the "car of the future" resembles a submarine boat more than it does a carriage. Its long cigar-shaped body incloses everything except the wheels, and even they are covered for almost half of their diameter

The Future Car

How Car Bodies Have Developed at Home and Abroad

By Walter Baunard

In automobile designing as well as in political movements coming events cast their shadows before them. If we would visualize the car of the future, we have only to study the car of the past. That is the object of this article. In order to obtain a correct impression of the automobile of the future, the author has presented and criticised both the European and American cars designed during the last twelve years.—EDITOR.

THAT the first automobile bodies were in all respects nothing but adaptations of the older carriage bodies is fairly well known. Many of the readers of this periodical will remember the first cars of a dozen years ago, and their awkward appearance. They were the product of a compromise—and like most compromises, were very unsatisfactory. That the motor driven carriage was a thing apart and different from the horse-drawn rig early became evident to thoughtful designers of automobile bodies. But while they well realized the necessity of striking out in different directions, they were not at all anxious to make radical innovations. The conservatism of the majority of the human race resents upheavals of any kind, preferring rather a gradual elimination of the undesirable. The change from carriage body to automobile body therefore had to be made slowly, and at the present time we have about arrived at the half way station. The automobile of the future will look no more like the motor car of to-day than the limousine of 1913 looks like the *dos à-dos* of 1896. The limousine or torpedo touring car of the present year is but a link in the gradual transformation of the horse-drawn buggy into the completely enclosed, dust proof, silent and comfortable "car of the future."

In outward appearance the "car of the future" resembles a submarine boat more than it does a carriage. Its long cigar-shaped body incloses everything except the wheels, and even they are covered for almost half of their diameter. To the eye of the motorist of 1913 it may present too "squat" an appearance, owing chiefly to the low position of the body. The car has no running boards, no hood, no mudguards, no wind shield and no flapping top. The motor is carried in front of the driver, as in the ordinary motor car, while the various indicators are placed within easier reach of the driver's hand than is possible in the orthodox vertical or sloping dashboard arrangement. The curved plate-glass front of the body affords a clear view of the road ahead, while giving absolute protection from wind, dust and rain. Ventilation is achieved by narrow slits in the sides and top of the car. Conforming to the shape of the body, the doors are curved, reaching so close to the ground that an eleven-inch step is all that is necessary to enter the car. Ample space is provided in the rear of the hollow body for baggage and the carrying of spare tires and other parts, while the seating arrangements allow each passenger more room than he would have in a modern limousine, and far more than in the various seven-passenger models of the present day. Wind resistance and the danger

Fig. 1.—Car built for the German Emperor in 1903. It had a rear entrance, proof that the problem of efficient mudguards and running boards had not yet been solved.

Fig. 2.—A car designed for the German Emperor in 1905. There are still unmistakable signs of the carriage maker's hand

Fig. 3.—The German Emperor's 1907 car. Although it would not attract much attention to-day, the seat backs are stiff and vertical, the upholstery hard and thin. The driver has no protection.

Fig. 4.—A touring car of 1909

Fig. 5.—A splendid car built in 1910 for the President of France. Fore doors appear for the first time

Fig. 6.—A 1912 model, which, were it not for the presence of the tool box in the very middle of the running board, might be considered more beautiful than the graceful car shown in Fig. 7

Fig. 7.—A 1913 German model, a good example of neat designing

Fig. 8.—A 1906 American limousine.

Fig 9.—A 1907 American landaulet

Fig 10.—The few changes made since 1907 caused many to think this 1909 model the "car of perfection."

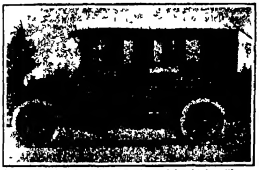


Fig 11—An American 1911 model which will not survive because of its peculiar broken appearance.

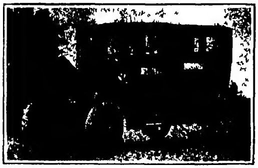


Fig 12.—This type of 1912 is objectionable for the reason indicated in connection with Fig 11

Fig 13.—A coupé type of 1913, which looks odd because the hood and dash-cowl combined are longer than the car body

Fig. 14.—A so-called brougham, designed in America, in which it is difficult to pick flaws.

of skidding are reduced to a minimum in this design, and a number of racing cars constructed on these lines have proven that greater speed can be attained. The tendency toward "stream line" bodies is clearly evident although opinions differ as to the ultimate design which will be evolved. To assist the reader in forming his own opinion of what the car of the future will look like I am showing herewith types of body construction in chronological order from 1903 to 1913.

The cars shown in Figs. 1, 2 and 3 were made for the German emperor in 1903, 1905 and 1907, respectively, and therefore may be said to represent the best type of these years. The first two are "rear-entrance" cars, built in this manner chiefly for the reason that the problem of efficient mudguards and running boards had not yet been solved. They are clearly attempts at producing something comfortable and suitable for motor propulsion, and still suggestive of the carriage maker's hand in the design. The manufacturers of the chassis and motors were already striking out in new directions at that time, but the body builders were still hampered by the traditions of the carriage industry

Fig. 3 shows a car which resembles the machines of to-day It could be driven down Broadway in New York city without causing sarcastic remarks among the pedestrians. But the backs of the seats are stiff and vertical the upholstery is hard and thin and the driver has no protection from the elements and the dust

The next illustration represents an immense step forward It is a splendid car built in 1910 for the president of the French Republic by a firm which supplied Napoleon with his court carriages more than a century ago It shows the fore-doors for the first time When professional chauffeurs did the bulk of the driving of motor cars, no one gave much attention to their comfort and convenience, but as soon as the private owner began to drive the car himself the necessity of doors for the front part of the car became evident A comparison with the preceding photographs shows some of the most characteristic and pronounced tendencies of that year The wheel base has grown longer, the steering column is set at a more 'rakish' angle, the steering wheel is larger in diameter the running boards are free from unnecessary boxes and litter of all kinds, and the whole car has more sweeping and pleasing lines.

Particularly graceful are the lines of the huge limousine shown in Fig. 6 Were it not for the presence of the tool box in the very middle of the running board, it might be considered a more beautiful car than the graceful model represented by Fig 7 The cars were built in 1912 and 1911 respectively—that is to say, they are the leading models of these years. The sweeping curve at the rear of the top in the 1912 model is undoubtedly more pleasing than the sharp edge of the following year's type, but the neat outlines of the mudguards and hood, the lower steering column and especially, the clear running boards are advantages which the earlier model does not show

The American automobile industry during those years kept fully abreast of its European rival The same faults and drawbacks are noticeable in both but there are also in evidence all the little improvements that were added abroad, in addition to some that were invented on this side of the Atlantic But for the peculiar construction of the body of the 1911 model in Fig 11, which makes it resemble two independent carriage bodies, stuck together as a sort of afterthought there is no need of apology on this maker's part The type is one which has a number of adherents, but which will not survive just on account of this peculiar 'broken' appearance. In more exaggerated form it is shown in Fig 16, which is a fine illustration of how an automobile body should not be designed. This style of construction is positively ugly—despite the fact that it may be comfortable and mechanically advantageous The car also appears bigger than it really is, which may or may not be desirable, according to the opinion of the purchaser The coupé type shown in Fig. 13 looks so odd chiefly on account of the extreme length of the hood, covering the six-cylinder motor, the hood and dash-cowl combined being longer than the entire body of the car

It is difficult to pick flaws in the construction of the body shown in Fig. 14—a so-called brougham. The first view of this car impresses one with the immense power and speed possibilities lying within it, and subsequent closer examination only strengthens this first impression. It is a body design which is in no way inferior to anything produced in Europe, and shows the present high state of the industry in this country The wheel-base of this car is practically thirteen feet.

An extraordinary European body construction is shown in Fig. 15. This type represents the latest idea in inclosing everything within the outer lines of the body, presenting a perfectly smooth exterior and greatly reduced wind resistance. Not only are the running boards absent, but the

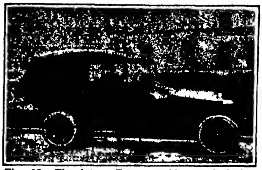


Fig. 15—The latest European idea in inclosing everything within the outer lines. Complete protection is afforded to baggage, spare tires and tools.

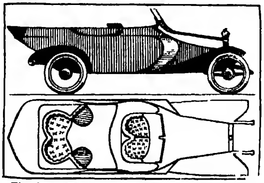


Fig 15a.—Elevation and plan of car in Fig 15

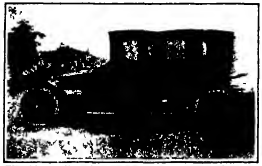


Fig 16—A French type of 1912, conspicuously ugly for its angles.

Fig 17.—A modern French roadster in which an attempt is made to obtain smooth lines.

Fig 18.—A good example of present French tendencies.

Fig 19.—A 1912 phaeton which has a distinctive body suggesting speed and comfort

body itself hangs over the wheels, giving plenty of room to the six passengers. The car is by all odds the most radical innovation in the line of body design, and from reports from abroad is expected to be placed in commission during the coming season by at least one prominent foreign maker. The car was shown built on an ordinary chassis at the last automobile show in Berlin, Germany, and created a veritable storm of discussion and criticism. It is the most comfortable design that has as yet been evolved, and the complete protection it affords to the baggage, spare tires, tool boxes, etc., is of great value to the long distance tourist.

French roadsters of peculiar shape are shown in Figs. 17 and 18, but a detailed description of their features is hardly necessary, as an examination of the illustrations will disclose their peculiarities.

The designing of bodies for motor cars is becoming more and more standardized. Only a few years ago body builders made a few special designs for each manufacturer and there were hardly any two of them alike. Then too the customer, particularly abroad, used to purchase his own bodies, made according to his preferences and ideas. The best example of this is the made-to-order car which some time ago was built for a wealthy American lady and which actually was measured so as to fit her figure as closely as possible. While other automobile purchasers were not quite so particular as to just how the body fitted them, they did express preferences which the body builder had to consider. As a result a number of freak bodies are now roaming this country as well as Europe. In many instances their owners are heartily weary of looking at them.

A standardization in body design, therefore, is very desirable not only from an economical standpoint as also from the more altruistic one of beauty—as opposed to freakish contraptions. It is cheaper to build one thousand good automobile bodies after one and the same design than it is to build one thousand mediocre ones after the individual designs of one thousand persons. Besides, the metal body is driving out the wooden body and it will not be long before the aluminium automobile body will reign supreme. In this country the use of metal bodies is increasing tremendously and the greater ease of manufacture, cheapness and practical indestructibility make them favorites with manufacturers demanding large quantities of bodies.

Many of the automobile manufacturers make their own bodies, in this country at least, and there is naturally an increasing tendency on their part to specialize on a few popular designs instead of pleasing each customer individually. In Europe it is still the custom in most cases to sell the chassis alone and have the customer order his own body attached. A much greater diversity among European cars is the result, and while this may appeal to some people it is decidedly uneconomical. At any rate one must admit that a manufacturer who makes it his business to design automobile bodies knows better what would suit a customer than the latter himself.

The trend of the trade, if examined carefully, shows the preponderance of four types of cars, and by gradual elimination of the various freaks and semi-freaks produced annually these four types will be generally accepted as standard for all cars and by all manufacturers. They are: The inclosed coupé for two and four people, the limousine for five to seven people, the race-about or roadster for two people and, finally, the open torpedo touring car for five to seven people. These four types cover the whole field and until the actual arrival of the "car of the future" will be found sufficient to meet all requirements.

Aeronautics and Aviation in 1912

THE year 1912 has witnessed greater development in aerostation and aviation than any other year since the heavier than air machine was introduced. Both sciences have been put to active military use by most of the large nations, and several nations have used dirigibles and aeroplanes to good effect in real warfare. At the end of 1913 it is possible that we shall have to record battles in the air. Just as last year there were several collisions, not all of which were fatal. At present guns for aeroplanes to use in attacking other aircraft are an established fact, one of the best of these being the invention of Lieut. Cleland Davis, U. S. A., while Lieut. Riley W. Scott has perfected a bomb-dropping apparatus that leaves nothing to be desired, and has won with it the Michelin prize of $15,000. He stands ready to deliver his device to any War Department that wants it and to instruct military aviators in its use. Lieut. Scott made a total of 8 out of 15 hits in dropping his projectiles from a height of 2,660 feet upon a 128 foot target.

The principal lines of aeroplane development last year were two: military and hydro-aeroplanes. England held a contest for military aeroplanes last fall like that held in France in 1911, while all the leading nations used aeroplanes in the annual maneuvers. At the close of the French maneuvers no less than 72 aeroplanes were reviewed by the Minister of War, and French pilots thought nothing of flying 360 miles a day during the war game. Flights totaling 43,000 miles were made in about a week's time. In the maneuvers in Connecticut and on the Pacific coast, Wright and Curtiss army biplanes were used. It was found possible to report to headquarters by wireless from a distance of 20 miles just what was occurring at the front. The chief difficulty experienced was the inability of the machines to carry two men—the first requisite of a military aeroplane.

After meeting with pronounced success the first of last year in the continuation of his hydro-aeroplane experiments at San Diego, Cal., Glenn Curtiss sent Hugh Robinson to the Monaco meet—the first hydro-aeroplane meet—in March. Robinson astonished the foreigners by his ability to navigate upon the open sea at Monaco. He had to compete only with a few other biplanes upon which floats had been hastily fitted. The result was that all Europe caught the "water plane" craze, and in the fall a number of hydro meets were held. At the Aero Club Show in the Grand Central Palace last May, Grover Cleveland Loening, the author of "Monoplanes and Biplanes," exhibited the first "flying boat," consisting of a monoplane, the body of which was watertight and formed a hull. He later made successful flights with this new craft. Donnet Lévêque, in France, applied such a hull to a biplane in which André Beaumont flew from Paris to Boulogne over water.

Curtiss brought out a similar flying boat and our Navy has recently purchased one. The advantage of this type of hydro-aeroplane is that it can skim the surface of the water at 50 miles per hour and make 60 miles per hour a few feet above the surface without the least danger to the occupants. As many as four persons have made a trip of an hour or more in a French flying boat. There has been but a single fatal hydro-aeroplane accident, and that was due to foolhardiness, as mentioned in a recent issue. One of these machines gives the double pleasure of flying and motor boating with the dangers of the former entirely eliminated. Wheels may be fitted for land use as well, if desired.

Aerostation in America received a severe set-back early in July through the bursting of what was practically her only dirigible. The "Akron" exploded early in the morning of July 2nd, while maneuvering above the shallow water of the inlet at Atlantic City. Melvin and Calvin Vanniman and the three other men that formed the "Akron's" gallant crew fell to their deaths. Melvin Vanniman, since his attempt at crossing the Atlantic with Wellman in the "America," had given his entire energy to the accomplishment of this feat. Finally, securing the financial backing required, he had constructed the "Akron" for this purpose, but while building her he made an improvement which consisted of weaving wire in the cloth forming the gas bag, so that the completed envelope was wirewound like the barrel of a wirewound gun. The gas bag would thus be strong enough to withstand the increase in pressure arising from heating and consequent expansion of gas. The envelope of the "Akron" Vanniman thought was strong enough to withstand a considerably increased pressure, and it is believed he allowed the pressure to increase when the sun came from behind a cloud, with the result that a weak section of the envelope gave way.

An equally appalling aviation accident that occurred on July 1st was the flinging out of her 70 horse-power Blériot monoplane of Miss Harriet Quimby and W. A. P. Willard, at the Boston meet. Willard, who was some distance behind Miss Quimby, was flipped from his seat probably as the result of suddenly developed gyroscopic force, and Miss Quimby immediately followed him. Both fell a thousand feet into shallow water and were killed. Miss Quimby shortly before, had won the honor of being the first and only aviatress to this day to fly across the English Channel. She used a 50 horse-power Blériot and made the flight from Dover to Calais in foggy weather. She landed at Hardelot 40 minutes after starting. Her accident at Boston would not have resulted fatally were two devices, which have since been perfected, been obtainable at that time. One of these is a gyroscope-compressed air automatic control for aeroplanes, which has been arranged to give automatic stability in all directions, and the other is a safety parachute of Japanese silk, weighing 6½ pounds, which is carried on an aviator's back like a knapsack and opens instantly when he is thrown out of his machine. Both are the inventions of Americans prominent in the electrical and aeronautic industries.

While there have been many long-distance aeroplane flights abroad, such as the 650-mile flight of Audemars in two days from Paris to Berlin, the only one of note in America was the 1,500-mile trip of Anthony Jannus from Omaha, Neb., to New Orleans in a Benoist hydro-aeroplane. Jannus' flying time was 31 hours 43 minutes. He stopped at many towns en route, and gave exhibition flights. The 471 miles from Kansas City to St. Louis were covered by Jannus alone in 9 hours 28 minutes, which is one fourth faster time than the express trains make. The 1,080 miles remaining were covered with a passenger and an 85-pound case of beer. The journey was made without any serious accident, the winding rivers being followed the entire distance. The replacements to plane and engine did not amount to $20.

All speed records were broken in the Bennett Cup race at Chicago on September 9th, when Vedrines, on a 140 horse-power Deperdussin "monocoque," covered the 124.8-mile course in 1 hour 10 minutes 57 seconds at the rate of 105½ miles per hour. He covered 10 kilometers in 3 minutes 27 3/5 seconds, or at a rate of 107.68 miles per hour. The American monoplane with 160 horse-power Gnome motor, built to defend the cup, was never flown.

As for the duration record, this was again raised by Fourny on a Maurice Farman biplane from 11 hours to 13 hours and 18 minutes on September 11th. A distance of 628 miles was covered over a 10-mile circular course. In America Lieut. John H. Towers, on October 6th, made an endurance record of 6 hours and 10 minutes with a 75 horse-power Curtiss hydro-aeroplane, while on October 31st Walter E. Johnson, at Bath, N. Y., carried a passenger for 3 hours 51¼ minutes with his Thomas biplane fitted with a 65 horse-power Kirkham 6-cylinder motor. The greatest total distance covered across country in a single day was the 570 miles between Valenciennes and Biarritz, traversed by Pierre Dancourt in his 50 horse-power Borel monoplane also on October 6th.

Three notable altitude flights were made the latter part of the year, two by Garros and one by Legagneux. The record was raised each time 1,000 feet or more. Garros now holds it with 5,601 meters (19,032 feet), subject to revision. He made the record at Tunis and then flew to Sicily—160 miles oversea—and thence to Italy and Rome—a total distance of 700 miles. This was the most daring over-water flight since Lieut. Bague was lost.

The international balloon race started from Stuttgart, Germany, on October 27th. The race was won for France by MM. Bienaimé and Rumpelmayer in the balloon "Picardie." A landing was made near Moscow, and a new record of 1,364 miles was set up. Leblanc was second with 1,240 miles, and John Watts of St. Louis, third, with 1,000 miles.

The acquirement of aeroplanes by our Navy will probably be rapid from now on, since Capt. Charles deF. Chandler has invented a catapult, making it possible to successfully launch an aeroplane from the deck of a battleship. The Navy already has four hydro-aeroplanes, and one flying boat in addition to eight or ten biplanes possessed by the Army. Recent experiments with the Navy hydros have shown that submarines can be easily located when completely submerged even in rather muddy water. The wreck of the American warship "Philadelphia," which stranded off Tripoli in 1802, was recently discovered from an aeroplane.

Future biplanes purchased by the Government are all to have monoplane bodies of streamline form, bodies similar in many respects to that of the Benoist biplane used by Jannus. The twin motored and duplicate twin propellered Wright biplane which the late Howard W. Gill was to have flown in the Gould SCIENTIFIC AMERICAN $15,000 two-motor prize contest on July 4th last, also had a body with aviator's seat therein. The above event was declared off as Mr. Gill was the only entrant ready to appear at the stated time and place. In England lately successful flights have been made with a two-motored biplane, and Grahame-White expects to fly to America in 30 hours next summer with a machine fitted with four motors of 250 horse-power each. The idea promulgated by Mr. Edwin Gould has, therefore, fructified.

Subsidizing the Motor Car

WITH a view of calling them out for mobilization, the French as well as the German government allows annual subsidies to owners of power wagons, provided these are of the approved types according to the War Department specifications. The leading constructors are now building their wagon trucks with this end in view, and this leads to a standardising of the chassis as regards certain general sizes and other features, not interfering, however, with individual construction. The rules call for a 4-cylinder motor in all cases, and the preferred type carries about 3 tons load. Strict rules provide that the French cars shall be built entirely of home material. The 3-ton car receives a first subsidy known as purchase subsidy of $600 and an upkeep subsidy of $200 during 3 years following. In Germany the 5-ton wagon has subsidies of $1,000 and $250, respectively, for the same cases. Great Britain is now entering the movement, but the subsidies, $40 to $60, and $75 annual are much smaller. Austria has a similar system.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Wanted: A Small Gasoline Plow

To the Editor of the SCIENTIFIC AMERICAN

The above heading being made by one Mr E M Bleakslee, and answered from the standpoint of the owner and operator of a gasoline outfit of this sort in the December 7th issue of the SCIENTIFIC AMERICAN, I have a few suggestions to offer (being a student of mechanics in general) that might be useful.

Now, to get at the root of the thing A small gasoline plow to be economical should essentially be light in weight and of corresponding small horse-power, so that fuel would not be too costly But it must have as great tractive power as possible. Therefore, I believe that the novel traction wheel and tractor described in the SCIENTIFIC AMERICAN of September 7th, 1912, comes nearest solving the problem It comes under the heading "Novel Italian Traction System"

Porterville, Cal. ALBIN A ANDERSON

The Gyroscopic Effect of Motors

To the Editor of the SCIENTIFIC AMERICAN

In re this discussion as to the gyroscopic action of rotary motors, and especially as to aviators' experiences in the matter, the writer has come across the following footnote bearing on the question in a pamphlet entitled "Cantor Lectures on Aeronautics," by Charles Cyril Turner, being some lectures delivered before the Royal Society of Arts in 1910

"It appeared subsequently, however, that with this rotating motor working at greater speed, it has a gyroscopic effect, and Delagrange, shortly before his fatal accident, told his friend, M Gasnier, that it kept the machine so rigid that he found it almost impossible to alter his course by moving the elevating plane, and that in order to descend he had to slow the engine slightly C C T"

It would appear that any danger due to the gyroscopic action of rotary motors—and also propellers would exist only with very sudden changes of direction, such as might be caused sometimes by a sudden upward downward or sidewise wind-gust striking only part of the aeroplane or different parts at different moments, and that the aviator would rarely if ever change the direction of movement suddenly enough to bring this gyroscopic force into dangerous play, for it is well known that gyroscopic force increases with the square of the speed with which the plane of rotation is changed

It would also appear that gyroscopic force could be put to good use in steadying or even balancing a flying machine by producing a balanced effect with two or three sets of revolving motors—or motors and propellers—situated in both horizontal and vertical planes, each set consisting of two revolving in opposite directions, while one set of vertically revolving motors might extend fore and aft and the other transversely of the machine It would be interesting, at least, to see these things tried

Livermore, Cal. ELMER G STILL

The Gyroscopic Action of Gnome Engines

To the Editor of the SCIENTIFIC AMERICAN

I should like to make a few remarks on Mr Earle L. Ovington's letter published in your issue of December 7th on the death of Paul Peck and gyroscopic force in an aeroplane using an engine of the rotary type

In his letter Mr Ovington asks if anyone has ever heard of an aviator who has really had experience with a rotary motor complain about its gyroscopic action Of course Mr Peck is dead and it would be a very easy matter for anyone so desiring to credit statements to him which he might have or might not have made Mr Ovington makes the statement that it was a fact that Mr Peck was never aware of any gyroscopic action According to him, therefore, it must be so, but it might be a good idea to hear from another aviator on the same subject. A few days before Mr Peck was killed Mr John D Cooper, licensed pilot No. 60, questioned him in regard to his motor, and especially in regard to any gyroscopic action that it might develop. Mr Cooper had never flown with a rotary motor, but was considering the buying of one. Naturally he was desirous of learning all about them from an aviator who had had considerable experience with one.

Mr Peck told Mr. Cooper that in making a turn he did feel the gyroscopic action of his motor, and especially if he was making a spiral. He said that in making the first turn he only felt the action slightly, but that in the second turn it was very strong, and that he seldom dared complete the third circle of the spiral. It was undoubtedly in making more turns than his judgement had heretofore advised him to make, owing to the gyroscopic action, that he lost control of his machine and the sad accident occurred which resulted in his death For we all know that it was in making a spiral that he met his death, and that the machine never seemed to come out of its steep bank the least bit during its descent, even though Mr Peck could be seen using his controls, trying to bring it back to a level position There can be little doubt about the gyroscopic action, about which he had spoken only a few days previous, having been too much for the controls of the machine once its full force was felt

I have every reason to believe Mr Cooper's statement in regard to his interview with Mr Peck

I cannot blame Mr Ovington for being so loyal to the type of motor that he has used most, for it is a poor kind of a sportsman who will not stand up for his favorite machine or motor and especially when it has won as much for him as his, for we all know that he flew more miles in 1911 in a rotary-motored monoplane than any other pilot in the United States I can only admire him for defending it so strongly, for its merits have been shown time and time again, but I fear that his arguments of late have been bordering very closely to narrowness, and he gives the impression that he is far from being open to conviction

While I have not had a great deal of experience in flying with a rotary motor, I have made a number of flights in the most successful type of American-manufactured biplane, which happened to be equipped with one I can truthfully state that I felt the gyroscope action whenever I made a turn with it, much more than I had ever felt it when using the stationary type of motor And I can vouch for it that every student whom I instructed on that machine last winter in California will say the same thing of it I am not foolish enough to ever think of knocking the rotary motor, for the wonderful records which have been made with it stand out as a glorious monument to its design I simply state that there is a gyroscopic action when it is used, and this is far from being negligible in practice

Hammondsport, N Y JOHN LANSING CALLAN
Licensed pilot No 102 F A I

[The Editor can publish no more letters on this subject]

Control of the Mississippi

To the Editor of the SCIENTIFIC AMERICAN

In the December 7th number of the SCIENTIFIC AMERICAN there was published a letter by Mr N J Noble concerning the control of the floods of the Mississippi River Mr Noble suggests as a remedy "the construction of reservoirs in the upper courses and tributaries, in the case of the Mississippi the numerous tributaries of the Missouri in particular"

Possibly in the case of the Missouri Mr Noble's plan may be of some merit but the contrary most certainly appears to be the case with the Mississippi itself Close to the head waters of the Mississippi in northern Minnesota, at Leech, Winnibigoshish and Pokegama lakes the United States War Department has already constructed three large concrete dams, forming reservoirs many square miles in extent in the lakes and swamps through which the river passes These dams have been completed and in operation for several years quite a sufficient time to demonstrate their value in the control of floods, but the results obtained in that direction are very doubtful, so doubtful in fact that there has been serious complaint from people living on the lower lands along the river for at least three hundred miles below the dams, that their presence increases rather than decreases floods

One reason that a system of reservoirs does not control floods seems to be that the straw that breaks the camel's back, the extra water that causes the flood, comes on top of reservoirs already filled by a long wet season or by the annual spring freshet. It is not the unusual annual freshet that causes floods, but any unusual fall coming on top of this

This has been shown by the reports of experts who have investigated the influence of a forested watershed on stream flow as compared with a non-forested one The forest floor acts as an enormous reservoir, absorbing and retarding for a considerable period large amounts of water, and thereby regulating stream flow and lessening the volume of many small freshets The authorities usually agree, however, that the ultimate high-water mark attained by the stream is not lowered by the presence of the forest, for the excess water that causes the serious flood always comes on top of a forest floor already saturated, a reservoir already filled, the result is quite as much run off as though the forest floor or the reservoir did not exist.

Mr Noble suggests that by reference to our geographies we may learn that "certain characteristics and facts pertain to all of that large class of rivers of which the Mississippi is one, namely, that those rivers have their rise in hilly or mountainous countries" If he will turn to any good contour map of Minnesota, or of the United States, he may be surprised to learn that the Mississippi does not rise in a mountainous or hilly country, but instead rises and flows for miles through a country of very slight relief and with an absolute elevation of only about 1,600 feet above sea level The result is that the reservoirs overflow several thousand acres of low-lying land, which they convert into festering mosquito-breeding swamps in summer and impassable tangles of prostrate water-killed timber in winter The lakes converted into reservoirs, instead of being a "thing of beauty and a joy forever," as nature made them, have their natural shore lines spoiled and in many places made inaccessible and their waters polluted with green algae and pond scum as a result of the widely shifting level and the thousands of acres of now submerged and now exposed flowage, which is caused by manipulating the gates of the dams to control the flow of water

Perhaps the Mississippi can be controlled by a system of dams, but results so far obtained in Minnesota seem decidedly to point to the contrary H R FLINT,

Osakis, Minn

The Inventor and His Reward

To the Editor of the SCIENTIFIC AMERICAN

As an inventor I am gratified at the firm stand you have taken for the protection of the inventor's rights in the discussion of the patent bill now before Congress and you certainly have justice on your side Article I, Section 8, of the Constitution says (par 8) "The Congress shall have power to promote the progress of science and the useful arts by securing for limited times to authors and inventors the *exclusive* rights to their respective writings and discoveries"

The word "exclusive" would seem to be broad enough to cover every point at issue, and would certainly cover the fixing of price and sales conditions by the inventor "Exclusive" certainly implies a monoply, and nowhere in the Constitution is Congress given power to abridge this grant other than by limiting the time it may run, and I am satisfied that the Supreme Court will take this view of the matter, in case the proposed bill should be passed

The wisdom of the framers of the Constitution in recognizing the rights of authors and inventors is amply proved by the history of industry in this country

The present stupendous wealth and prosperity of this country is due solely to its inventors This seems a strong statement to make, but it is easy to prove its truth

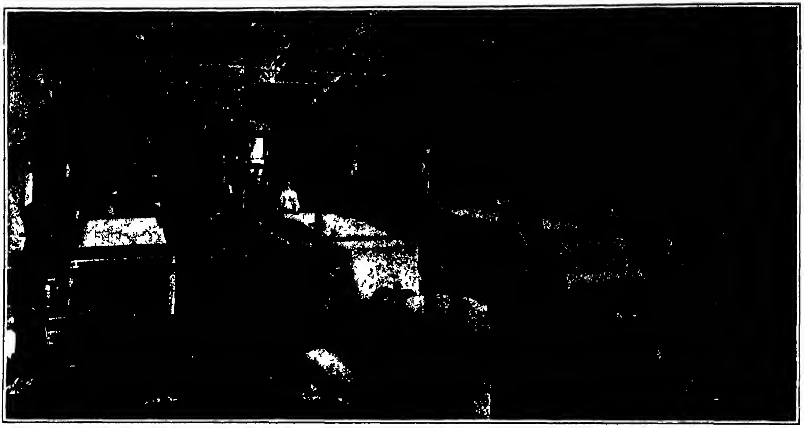
The vast resources have existed since prehistoric times, but their present utilization has been possible only through the work of the inventor The cotton gin made cotton a profitable crop the steamboat and the railroad made it possible to raise it in the interior and it has gone on increasing until this year Texas alone raised $300-000,000 of cotton The railroad, while first tried in England was first proposed by an American inventor and first brought to perfection here as a freight carrier The steamboat was distinctly American Agricultural machinery was the product of this country and without it the middle West would still be The Great American Desert" as it was once called Here intensive *farming* will not pay on account of scanty rainfall but extensive *farming* will, *and one man can* with the present labor-saving machinery farm as much as twenty men could by hand and do it better The Secretary of Agriculture estimates this year's farm products at nearly ten billion dollars How much would it have been without the American inventor? What per cent of this enormous sum goes to him for his inventions?

John Deere, who invented the modern plow, McCormick with the reaper Appleby with his twine binder, are dead their profits have long since ceased, but the country is still reaping the benefits Was the exclusive right to their inventions an injury? Goodyear struggled for years, in poverty and failure with splendid courage and hope, to make a useful product from the useless raw rubber His ultimate success and the right for seventeen years to control his invention was a small reward for his long struggle The Government could not give him back his time it could not return his youth, all it could do was to secure his rights for a few years Was this an injustice to the public? Of what account was his profit in the first years of the industry compared to the comforts and conveniences to which his invention gave birth? And his story is but one there are many others most of them obscure, who labored no less diligently to improve conditions and appliances of mankind, many like him confronted for years by poverty and bitter failure made still more bitter by the jeers of those they were striving to benefit

Is it any more than simple justice that they should be enabled to reap a monetary reward for the fruits of their labor? As you say, they have created something which did not previously exist and which would not have existed but for their efforts, and in which their right supersedes that of the public On the other hand the first years of the life of an inventor are the least profitable, and infringers frequently destroy what profit there is The case of the Wright brothers is pertinent They risked their lives in making flying a success and have been engaged in expensive litigation since the issue of their patents, to secure the rights and profits which were rightfully theirs.

Instead of detracting from the value and profits of an inventor it would *seem* more worthy for Congress to secure the inventor more fully in his constitutional rights

Omaha, Neb L. W SMITH



The spreader room of a rubber factory

The Making of a Pneumatic Automobile Tire

A Trip Through a Tire Factory

By E. R. Hall

CRUDE rubber never reaches the manufacturer clean. Before it can be converted into a tire it must be washed. First it is cut up into small pieces, put into large vats of warmed water and allowed to soak in order to soften it sufficiently to be broken down in the machines. By means of a cracker, a machine consisting of two rolls with projections on their surfaces shaped like little pyramids, the two rolls revolving with a differential, one going considerably faster than the other, and being adjustable so that they can work close together or with some distance between them, the rubber is broken down into a coarse spongy mass. Water flows on to the rubber during the process, bringing down sand, dirt, bark and the many other foreign materials which come mixed with the rubber. The rubber is put through this machine a number of times until it is worked into a uniform condition. Some of the rubbers, like the Ceylons and Paras, will sheet out into a coarse sheet by being put through this machine, others, like the majority of the African rubbers, will fall apart and come down in chunks and have to be fed into the machine with a shovel.

After the rubber is broken down sufficiently in the cracker, it is next put through a washing machine built like a cracker, except that the rolls are grooved or rifled so that their action is not so severe. Water constantly runs over this machine, and the rolls work very close together, so that the rubber is finely ground and run out into a thin and comparatively smooth sheet, allowing the water flowing between the rolls to take out practically all of the foreign matter that remains. Some types of rubber, such as Mangabeira, which have large quantities of sand in them, are washed in a special form of washing machine known as the beater washer—an endless, oval-shaped trough with a fast revolving paddle wheel. In this machine the rubber is submerged in water after being broken down in the cracker, and the sand is literally knocked out of it by the paddle wheel. The sand drops to the bottom of the machine, where it is drained off, while the rubber floats to the top to be gathered and then put through a regular washing machine for the final sheeting out.

Mounting the partially cured tire on a rim preparatory to final vulcanization in inflated form

Machine for cutting the fabric into bias strips.

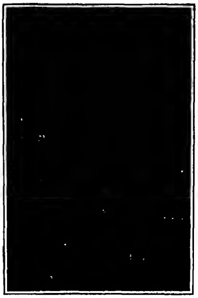
How the Rubber is Dried.

Before the rubber can be used in any articles of commercial value it must be thoroughly dried. Any moisture in the stock would turn to steam during the vulcanizing process and give rise to blisters or blow holes in the goods. There are two ways in which rubber is usually dried. The method mostly used and generally practised with all the better grades of gums, is to hang the washed strips on horizontal poles and space them in aisles, so that air may freely circulate around the surface of the rubber, the dry room being kept at a constant temperature. To dry the rubbers properly by this method takes from four to six weeks.

The other method is vacuum drying. Low grade rubbers which have a comparatively large percentage of resin in their composition cannot bear their own weight when hung on horizontal poles, but drop off. Hence these rubbers have to be dried in a peculiar manner. They are laid in trays which are placed into a large air-tight receptacle. Then the air is withdrawn and the interior heated by means of steam coils. Thus the water is evaporated from the rubber at a considerably lower temperature than that at which water boils under atmospheric pressure, and at such a low temperature, and in such a short time, that the rubber is not affected. By this process, these rubbers can be dried in a few hours.

Ingredients and Their Purpose.

After having been thoroughly dried, the rubber is ready to be mixed in proper proportions with the various ingredients, which give the desired quality for various products. In order that rubber shall vulcanize, it is necessary to mix with it a certain proportion of sulphur, vulcanizing, or curing as it is sometimes called, being merely the changing of a physical mixture of rubber and sulphur into a chemical



Applying the tread.

Arranging fabric on tire-building machine

The wrapping room of a pneumatic tire plant

compound of these ingredients, by the application of heat. Besides sulphur some of the more important ingredients used in compounding rubber are:

Zinc Oxide. This toughens the rubber and increases its wearing properties and tensile strength.

Barium Sulphate. This stiffens the rubber and adds weight, so reducing the cost.

Lithopone. This whitens the stock and makes it soft, and is used extensively in druggists' sundries.

Antimony Sulphide. This makes the stock red and is a preservative against oxidation.

Litharge. This has the same action as antimony sulphide but makes the stock black.

White Lead. This hastens the cure and is extensively used in gray and black stocks and is a good filler or weight adder.

Magnesia Oxide and Carbonate. These are used as fillers for white stocks.

Oxide of Iron. Used for coloring red and yellow stocks.

Lime (unslaked). This hastens vulcanization and chemically removes any water left in the rubber.

Whiting. This is used only as a cheap filler to increase quantity and lower cost.

Aluminium Silicate. This is used chiefly as a filler.

The various ingredients mixed with rubber are not put into the compounds merely to cheapen the product and to lower the grade of the material. While true of molded goods, rubber heels, bicycle grips, automobile bumpers, etc., it is not true of tires, packing, belting, etc. Ingredients are added in the case of tires

Finishing pneumatic automobile tires

Room where the compounded rubber is put through calenders.

to toughen the gum, increase its wearing qualities, to make it indestructible when subjected to heat, or to make it soft and yielding so that it can be forced into fabric, etc.

In the general process of manufacture the sheeted rubber is sent directly from the dry room to the compound room where the various ingredients are weighed out into proper proportions along with the rubber to make up a batch and placed in receptacles ready to be mixed. The batch is then sent into the mill room to be mixed into a uniform pasty mass, which is the characteristic uncured or so-called green rubber compound. The mixing is done in the mill, a very heavy machine resembling a cracker and a washer, except that it is much larger and heavier and that the rolls are perfectly smooth and run closer together. No water at all is used on the batch during the mixing.

After the batch is properly mixed it is cut off the rolls in sheets and rolled up and sent to the green stock storeroom. In this storeroom the compounded uncured gums are kept in different bins according to the nature of the compound and are there allowed to season a certain length of time, after which they are delivered to the various departments of the factory in which they are to be used.

Another form in which rubber is used is the so-called rubber cement. Rubber or any of its compounds are readily soluble in naphtha. In this process the compounds after being milled are macerated in specially constructed cement mills and there mixed with a certain proportion of naphtha which gives a thick solution

(Continued on page 51.)

Single cure process: The whole tire vulcanized after the tread has been applied.

Location of Gasoline Engine Troubles Made Easy

A Comprehensive Exposition of the Common Derangements That Interfere With Efficient Operation of All Types of Four-Cycle Internal Combustion Motors

Tables compiled by Victor W. Pagé, M.E., author of "The Modern Gasoline Automobile"

INSTRUCTIONS FOR USE

This chart has been prepared to outline in a simple manner the various troubles and derangements that interfere with efficient internal combustion engine action. While the form illustrated is a type used as a motor-car power plant, the parts and their functions are practically the same in all gas or gasoline engines of the four-cycle type, and the general instructions given apply just as well to all hydro-carbon engines, even if the parts differ in form materially. The essential components are clearly indicated in the part sectional drawing so they may be easily recognized. The various defects that may materialize are tabulated in a manner that makes for ready reference, and the various defective conditions are found opposite the part affected, and under a heading that denotes the main trouble in which the others are contributing causes. The various symptoms denoting the individual troubles outlined are given to facilitate their recognition in a positive manner.

Brief note is also made of the remedies for the restoration of the defective part or condition. It is apparent that a chart of this character is intended merely as a guide, and it is a compilation of practically all the known troubles that may materialize in gas-engine operation. While most of the defects outlined are common enough to warrant suspicion, they will never exist in an engine all at the same time, and it will be necessary to make a systematic search for such of these as exist.

To use the chart advantageously, it is necessary to know one main trouble easily recognized. For example, if the power plant is noisy look for the possible troubles under the head of Noisy Operation. If it lacks capacity, the derangement will undoubtedly be found under the head of Lost Power. It is assumed in all cases that the trouble exists in the power plant or its components, and not in the auxiliary members of the ignition, carburetion, lubrication, or cooling systems. The novice motorist and student will readily recognize the parts of the average engine by referring to the very completely outlined and clearly lettered sectional drawing in the illustration.

"SKIPPING" OR IRREGULAR OPERATION

PART AFFECTED.	NATURE OF TROUBLE.	SYMPTOMS AND EFFECTS.	REMEDY
Compression Relief Cock.	Leak in threads or spigot.	Dilutes mixture with air causes blowback.	Screw down tighter. Grind spigot to seat with emery
Spark Plug.	Leak in threads. Defective gasket. Cracked insulator. Points too near. Points covered with carbon. Too much air gap.	Dilutes mixture. Allows short circuit. No spark.	Screw down tighter. Replace with new. Set points 1-64" apart for magneto, 1-32" for battery spark.
Valve Chamber Cap.	Leak in threads. Defective gasket.	Dilutes mixture by allowing air to enter cylinder on suction stroke.	Previously given.
Combustion Chamber	Carbon deposits.	Preignition.	Scrape out.
Valve Head.	Warped or pitted. Loose on stem.	Dilutes charge with poor air or gas.	Previously given.
Valve stem.	Binding in guide. Sticking.	Irregular valve action.	Previously given.
Valve Seat.	Scored or warped. Cracked. Covered with scale. Dirt under valve.	Gas leak, poor mixture. Poor compression. Valve will not close.	" "
Induction Pipe.	Leak at joints. Crack or blowhole.	Mixture diluted with excess air	Stop all leaks.
Inlet Valve.	Closes too late. Opens too early	Blowback in carburetor	Time properly
Exhaust Valve.	Opens too late. Closes too early	Retention of burnt gas dilutes charge	Time properly
Valve Stem Guide.	Bent or carbonized.	Causes valve to stick.	Previously given.
Inlet Valve Stem Guide.	Worn, stem loose.	Air drawn in on suction thins gas.	Bush guide or use new member
Valve Spring.	Weakened or broken.	Irregular action.	Use new spring.
Valve Stem Clearance	Too little. Too much.	Valve will not shut. Valve opens late, closes early	Adjust gap .025" inlet, .008" exhaust.
Valve Spring Collar Key	Broken.	Releases spring.	Replace
Cam.	Worn cam contour. Loose on shaft. Out of time	Valve lift reduced. Does not lift valve. Valves operate at wrong time	Previously given.
Camshaft Bearing.	Looseness or wear	Valve timing altered. Valve lift decreased.	Replace.
Camshaft.	Twisted.	Valves out of time	Previously given.
Cam Fastening.	Worn or broken.	Valve action irregular	Replace with new
Valve Operating Plunger	Loose in guide	Alters valve timing	Replace with new
Valve Plunger Guide	Wear in bore. Loose on engine base	Alters valve timing	Replace or bush. Fasten securely
Timing Gears.	Not properly meshed. Loose on shaft.	Valves out of time. Valves do not operate	Remesh properly. Fasten to shaft.
Piston.	Walls scored.	Leakage of gas.	Smooth up if possible
Piston Head.	Carbon deposits. Crack or blowhole core	Causes premature ignition.	Previously given.
Piston Rings.	No spring. Loose in grooves. Worn or broken.	Leakage weakens suction.	" "
Cylinder Wall.	Scored by wristpin. Scored by lack of oil.	Gas leaks by. Poor suction	" "

LOST POWER AND OVERHEATING

PART AFFECTED.	NATURE OF TROUBLE.	SYMPTOMS AND EFFECTS.	REMEDY
Water Pipe Joint.	Loose.	Loss of water, heating.	Tighten bolts, replace gasket.
Spark Plug.	Leakage in threads, insulation, or packing.	Loss of power. Hissing caused by escaping gas.	Replace insulation if defective, screw down tighter
Compression Release Cock.	Leak in threads. Leak in fitting.	Loss of power. Whistling or hissing.	Tighten if loose. Grind fitting to new seating in body
Combustion Chamber.	Crack or blowhole. Roughness. Carbon deposits. Sharp edges.	Loss of compression. Pre-ignition.	Fill by welding. Smooth out roughness. Scrape out or dissolve carbon.
Valve Chamber Cap.	Leak in threads. Defective gasket.	Loss of compression. Hissing.	Remove. Apply pipe compound in threads and replace. Use new gasket or packing.
Valve Head.	Warped. Scored or pitted. Carbonized. Covered with scale. Loose on stem. (two-piece valves only)	Loss of compression.	True up in lathe. Grind to seat. Scrape off. Smooth with emery cloth. Tighten by riveting.
Valve Seat.	Warped or pitted. Covered with carbon. Foreign matter between valve and seat.	Loss of compression.	Use reseating reamer. Clean off and grind valve to seat.
Valve Stem.	Covered with scale. Bent. Binding in guide. Stuck in guide.	Valve does not close. Loss of compression.	Clean with emery cloth, straighten. True up and smooth off, free with kerosene.
Valve Stem Guide.	Burnt or rough. Loose in valve chamber	Valve may stick. Action irregular.	Clean out hole. Screw in tighter.
Valve Spring.	Weak or broken.	Valve does not close.	Replace with new.
Valve Operating Plunger.	Loose in guide. Too much clearance between valve stem.	Valve action poor. Lift insufficient.	Replace with new. Adjust screw closer
Valve Lift Adjusting Screw	Threads stripped. Too near valve. Too far from valve.	Poor valve action.	Replace with new. Adjust with proper reference to valve stem.
Valve Lift Cam.	Worn cam contour. Loose on shaft. Out of time.	Not enough valve lift. Will not lift valve. Valve opens at wrong time.	Replace with new. Replace pins or keys. Set to open properly
Camshaft.	Sprung or twisted.	Valves out of time.	Straighten.
Camshaft Bushing	Worn.	Not enough valve lift.	Replace.
Camshaft Drive Gear	Loose on shaft. Out of time. Worn or broken teeth.	Irregular valve action.	Fasten securely. Time properly. Replace with new
Cam Fastenings.	Worn or broken.	Valves out of time	Replace with new
Cylinder Wall.	Scored, gas leaks. Poor lubrication causes friction.	Poor compression. Overheating.	Grind out bore. Repair oiling system.
Piston.	Binds in cylinder. Walls scored. Worn out of round	Overheating. Poor compression.	Lap off excess metal. Replace with new
Piston Rings.	Loss of spring. Loose in grooves. Scored. Worn or broken. Slots in line.	Loss of compression. Gas blows by	Peen ring or replace. Fit new rings. Grind smooth. Replace. Turn slots apart.
	Carbon in grooves. Insufficient opening. Binding on cylinder	Overheating because of friction.	Remove deposits. File slot. Grind or lap to fit cylinder bore
Wristpin.	Loose scores cylinder	Loss of compression.	Fasten securely. Replace cylinder if groove is deep.
Crankshaft.	Scored or rough on journals. Sprung	Overheating because of friction.	Smooth up. Straighten.
Crank Bearings. Main Bearings.	Adjusted too tight. Defective oiling. Brasses burned.	Overheating because of friction.	Adjust freely, clean out oil holes and enlarge oil grooves.
Oil Sump.	Insufficient oil. Poor lubricant. Dirty oil.	Overheating.	Replenish supply. Use best oil. Wash out with kerosene, put in clean oil.
Water Space. Water Pipes.	Clogged with sediment or scale.	Overheating	Dissolve foreign matter and remove
Fan Belt.	Loose or broken.	Overheating.	Adjust or replace
Piston Head.	Cracked (core). Carbon deposits.	Loss of compression. Pre-ignition.	Weld by autogenous process. Scrape off carbon accumulations.

NOISY OPERATION OF POWER PLANT

PART AFFECTED.	NATURE OF TROUBLE.	CHARACTER OF NOISE.	REMEDY
Compression Release Cock.	Leakage.	Hissing.	Previously given.
Spark Plug.	Leakage	Hissing.	" "
Valve Chamber Cap.	Leakage.	Hiss or whistle.	" "
Combustion Chamber	Carbon deposits.	Knocking.	" "
Inlet Valve Seat.	Defects previously given.	Popping in carburetor	" "
Valve Head.	Loose on stem.	Clicking.	" "
Valve Stem. Valve Stem Guide.	Wear or looseness.	Rattle or clicking.	" "
Inlet Valve.	Closes too late. Opens too early.	Blowback in carburetor	" "
Valve Spring.	Weak or broken.	Blowback in carburetor.	" "
Cylinder Casting.	Retaining bolts loose. Piston strikes at upper end.	Sharp metallic knock.	Tighten bolts. Round edges of piston top.
Cylinder Wall.	Scored.	Hissing.	Previously given.
Valve Stem Clearance.	Too much. Too little (inlet valve)	Clicking. Blowback in carburetor.	" "
Valve Operating Plunger. Plunger Guide.	Looseness.	Rattle or clicking.	" "
Timing Gears.	Loose on fastenings. Worn teeth. Meshed too deeply	Metallic knock. Rattle. Grinding.	" "
Cylinder or Piston.	No oil or poor lubricant.	Grinding.	Repair oil system.
Cam	Loose on shaft. Worn contour	Metallic knock.	Previously given.
Camshaft Bearing	Looseness or wear.	Slight knock.	" "
Cam Fastening.	Looseness.	Clicking.	" "
Piston.	Binding in cylinder. Worn oval, causes side slap in cylinder.	Grinding or dull squeak. Dull hammering.	" "
Piston Head.	Carbon deposits.	Knocking.	" "
Piston Rings.	Defective oiling. Leakage. Binding in cylinder.	Squeaking. Hissing. Grinding.	" "
Wristpin.	Loose in piston. Worn.	Dull metallic knock.	Replace with new member.
Connecting Rod.	Wear in upper bushing. Wear at crankpin. Side play in piston.	Distinct knock.	Adjust or replace. Scrape and fit. Use longer wristpin bushing.
Crank Bearings.	Looseness. Excessive end play. Binding. Shaft too tight.	Metallic knock. Intermittent knock. Squeaking.	Refit bearings. Longer bushings needed. Insert shims to allow more play
Main Bearings.	Looseness. Defective lubrication.	Metallic knock. Squeaking.	Fit bearings closer to shaft. Clean out oil holes and grooves.
Connecting Rod Bolts. Main Bearing Bolts.	Loose.	Sharp knock.	Tighten.
Crankshaft.	Defective oiling.	Squeaking.	Previously given.
Engine Base	Loose on frame.	Sharp pounding.	Tighten bolts.
Lower Half Crankcase.	Bolts loose.	Knocking.	Tighten bolts.
Flywheel.	Loose on crankshaft.	Very sharp knock.	Tighten retention bolts or fit new keys.
Oil Sump.	Oil level too low. Poor lubricant.	Grinding and squeak in all bearings.	Replenish with best cylinder oil.
Valve Plunger Retention Stirrups.	Looseness.	Clicking.	Tighten nuts.
Fan.	Blade loose. Blade strikes casing.	Clicking or rattle.	Tighten. Bend back.
Fan Hub Bearings.	Broken ball.	Clicking.	Put in new ball.
Induction Pipe Joints.	Leakage.	Sharp whistle	Use new gasket.
Exhaust Pipe Joints.	Leakage	Sharp hissing.	Tighten or use new gasket.
Crankcase Packing	Leakage.	Blowing sound.	Use new packing. Tighten bolts.
Water Pipe.	Leaks. Loss of water. Clogged with sediment.	Pounding because engine heats.	Previously given.
Water Jacket.	Clogged with sediment. Walls covered with scale	Knocking because engine heats.	Dissolve scale and flush out water space with water under pressure.

The Riviera Gateway between France and Italy (Menton Vintimiglia)

Europe's Good Roads

What They Mean to Road Users

By Francis Miltoun

This article is a review of the best road engineering practice of Europe. While there are just as good roads in the United States to-day as in France, for example, our mileage of good roads is hopelessly outdistanced by the corresponding mileage of European countries that cannot compare with us in population or in national wealth. As a matter of business itself, the good roads question is one of the biggest on the economic horizon to-day. Americans should know how Europe is endeavoring to solve that problem. This article will tell them.—EDITOR.

Broad flat flagstones mark the through routes passing through Italian towns.

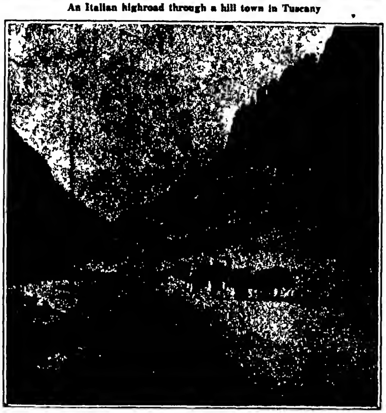
IT is no retrograde movement that proclaims comfortable travel by road as one of those twentieth century blessings which is our due. It is an axiom that the speedy railway development of the United States worked to the detriment and discouragement of scientific road building. Old Europe suffered under no such handicap. Roads, more or less perceptible were there. Take the case of France as the conclusive, concrete example because France has the greatest continuity and excellence of good roads to-day—since the Roman invasion, a fact which is evinced by one of the celebrated *bornes milliaires*—the mile stones of the Roman era—which sits beside a tree-bordered Route Nationale not a stone's throw from where these lines are written. The roads of Gaul were planned on grand lines: their great scope even at this late day cannot be denied and proves that they are a tangible expression of planning for the future. French roads of to-day follow these same general lines. It is thus that Europe got her start. What is more remarkable, France through the application of the same nation wide governmental and centralized roads control system, has endowed Algeria (in something less than three quarters of a century) with highways as good as those of the mainland itself. It is not solely then because a country is new that its roads should have been ignored or neglected, not even on the insistence of big business, for as a matter of business itself the good roads question is one of the biggest on the economic horizon to-day.

The Influence of the Romans.

All this has for long been recognized in France and her famous *Ecole des Ponts et Chaussées* (which gave the inspiration for the establishing of the highway engineering chair at Columbia University) turns out its road engineers all trained to the same methods. This of itself produces a uniformity of design and treatment which has done much toward putting French roads into the enviable class in which they stand. If a further endorsement of this paternalism were needed it can only be added that the recently founded department of the government, the *Office National de Tourisme*, is working hand in hand with the road building authorities for the provision of the funds necessary to build new roads which shall open up many hitherto closed regions to a rapidly increasing tourist traffic. This is not by any means an idle catering to the classes of leisure, the spenders; the development of a hitherto inaccessible region to tourists means that all the allied interests which may previously have languished will at least become producers able to furnish a more comfortable livelihood for many a mountain community which hitherto eked out but a perilous existence or emigrated to the shores of the Seven Seas. It was this combined effort of two friendly governmental departments which brought into being the magnificent *Route des Alpes* from Lake Leman to the Mediterranean—five hundred miles of superb mountain roadway through the Alps of Savoy and Dauphiny—and which in a like manner is achieving the *Route des Pyrénées* from the Bay of Biscay to the Mediterranean. The famous *Corniche d'Or* of the Esterels, too, a magnificent forty kilometer stretch of shelf like, cliffside Mediterranean, bordering the Riviera, just before Cannes, owes its existence to a like initiative. Formerly it was but a coast guard's trail, to-day it is the most beautifully disposed and most remarkably engineered roadway extant.

On a Swiss mountain road.

An Italian highroad through a hill town in Tuscany



The French have built fine roads in Algeria. This is the Col de Sfa, the gateway of the Garden of Allah (Biskra).

It is remarkable the wide interest that the road question has for all classes in Europe and it is this unity of purpose that builds on the network legacy left by the Romans. Since that time, and that of the Henris and the Louis, to whom were due much of the elements of beauty that compose the French road system to-day particularly with respect to tree planting alongside, and since the later day of the military road making genius of Napoleon much has been undertaken in the way of refinement which has produced, if not an actual money return, at least a prosperity which would otherwise have been unknown.

European and American Roads Compared.

To be just there are as good roads in the United States to-day as in France in top-dressing, in comport with the needs of the new locomotion, according to any one of the four or five methods commonly made use of in America results are superior even to anything yet achieved in Europe. That these "surface roads" are as durable is a question not for discussion here. The rock metalled, water bound macadam of Britain, precursor of the Frenchman, Trésaguet, the *pflaster* of Germany or the *pavé* of Belgium at their best are certainly no better to the eye, nor in actual practice when seated on luxurious upholstery and rolling on rubber tires, than much that may be seen in short lengths in some States of the Union.

Little has been achieved in Europe in the redressing of existing roadways with tar, asphalt, cement or any form of bitulithic carpeting which is known so favorably, in one form or another, in America, and which in most cases has been found superior to purely water-bound road-surfacing. In France, particularly, where the thing has been tried, pitiful results have accrued, notably on certain stretches along the Riviera, that battery of Mediterranean coast towns which has become the playground of princes, American millionaires and some others.

Brick is found on some roads of Holland, but it dates from before the automobile era, before even that famous pavement of Terre Haute, Indiana, owning already to some twenty years and still good. Great claims of durability are made for brick, and if these two examples have any weight, the thing would seem to be worth something.

In France there is a famous forty kilometer stretch of *Route National* in the south, near Marseilles, just after leaving Avignon and Arles on the road to the Riviera, straight as an arrow, flat as a billiard table and smooth as marble, with a road of wind-break cypresses on the north, which in the writer's opinion is the very nearly ideal roadway. French

National, Departmental and Communal roads, as a class, are the best in the world. Here and there, it is true, they are showing signs of wear, but the system of upkeep is such that they seldom degenerate into downright bad. From the Channel Ports to Paris there are superb bits of tree-lined roadway, wide well drained and marvelously engineered, the typical *Routes Nationales*, which have set the pace for all other main highways of the world. South in Poitou and through the Limousin are long silent stretches nearly as good. In the Pyrénées are found superb mountain highways on the French slope and something unspeakable on the Spanish versant, with the result that Alphonse XIII, Europe's automobiling monarch, does most of his road travel in France. In the French Alps are the finest mountain roads in Europe, far and away ahead of those of Switzerland on all counts. Many of them were due to the genius of Napoleon and his military road builders, and if their main purpose in times past was strategic, to-day they are certainly essentially practical. The Col du Mont Cenis, the Col de Mont Genevre, the Lanteret and the giant Gallbier (the highest carriage road in Europe save the Stelvio) at an elevation of a mile and two thirds, are the best of their kind, though commonly one thinks of the mountain republic of Switzerland or Italy or Austria when mountain roads are mentioned.

The Mountain Roads of Austria.

The mountain roads of Austria are a close second, particularly when it comes to considering them from the point of view of the automobile. The country is trying hard to get some of the thirty millions which is claimed to be left abroad each year by foreign automobilists in Europe, and it has accordingly put its mountain roads in shape and opened up many new ones within the last decade, until to-day there is a continuous round of fifteen hundred miles at no less an elevation than three thousand feet, with many of the passes, like that of the Stelvio well above six thousand. Autophobic Switzerland is a big loser with its circumscribed system of cantonal option, resulting that it is but a bridge for the "fast traffic" between Paris and the Italian Lakes instead of being the touring ground that it was in the eyes of a former generation. One enters Italy over the Saint Gothard or the Simplon or Tyrol over Arlberg, but a bare three hundred miles of cross country is all that is left to Switzerland on the main touring route, the valleys and many of the interior roads being given over exclusively to carriage and mail coach, horse-drawn traffic of the days of Mark Twain.

Italy has a nationalized roads system so has Belgium, Austria and most of the German Confederation. The first three meet the situation but partially, organization and control being decidedly inferior to that in France. Italy's *Strade di Grandi Communicazione* are sometimes good, more often bad, and around Naples, Rome and Florence and north toward the Italian Lakes *via* Milan they are too bad for words, having arrived at this disgraceful stage through sheer neglect or inattention rather than through any fault in the system of road building in itself. Level crossings, with great well sweep gates, always shut, abound—there are fifty of them between Vintimiglia and Spezia on the Italian Riviera, the Poor Man's Riviera, so-called to distinguish it from that around Nice and Monte Carlo.

To sum up and bring it home, there is nothing worse in Europe than stretches within half a hundred miles of Manhattan, and nothing quite so good, even in the Bois de Boulogne, as some of the hard-surfaced ribbon roads leading out into the Jersey Hills. Roads in Europe are an economic factor of life and not a fad, however. Recently we read of an army division in the Balkans which made a hundred miles with all its train in a little more than a week, and that truly is going some, even on a first class open road, and military strategic roads are invariably good roads, though they may not be so numerous or have the extent of those mundane thoroughfares which lead merely from town to town. Neither is the farmer abroad taxed in strength, patience, time or purse. In France he is assured a road grade which will enable his beast of burden to pull three tons at a walking gait without aid, an echo of a formula first promulgated by Napoleon—no grades upon which a mountain battery might not gallop at ten kilometers an hour. It is this general, foreordained, inter locking engineering scheme that puts the continental European roads from the Pyrénées to the Carpathians in the high class which they occupy as strategic military roads unexcelled anywhere. Their "feeders" are of the same general excellence resulting in a benefit to all sorts and conditions of society not automobilists alone,

National road through the forest of Fontainebleau.

The Gorges d'Ollioulles in the Maritime Alps.

though, to be fair it was the advent of the rubber tire that has caused the wide revival in the question of road travel throughout the civilized world.

England's Parochial System.

England's parochial system of road control is the chief of the difficulties which road users are experiencing in the tight little isle, and have experienced for long, though it is hoped that the newly founded Road Board (whose secretary, Mr. Rees Jeffreys, was recently in the United States to learn what he might with regard to the fining down of automobile roads, particularly with respect to surfacing) will remedy all this just as soon as it becomes really national in its functions and not merely advisory leaving the county and parish authorities to do pretty much as they please. Towns and villages in England are often so close together that a highway is frequently one long main street—narrow and twisting at that and the famous Bath Road of history, for a length not appreciably more than a hundred miles, is under control of a dozen different road builders, each with methods of his own. Results are variable. One length of but a few miles, entering London from the west, is under the *régime* of three different urban councils of greater London. In France, or in any of the continental countries where the national system prevails, this could not be.

Uniform control in France makes a national road of the main street of many a populous town and as such it is under the direct supervision of the national road building authorities and as goes without saying, is kept up to national standards often having a stone kilometer mark set into the facade of the town hall or a Gothic church which may date from the middle ages. It is as if the King's Highway, or *Route Royale* from which the French *Route Nationale* of to-day has descended, were ambling along in the open plain of La Beauce, the granary of France where, for miles on end there are nothing but waving wheat fields on either side no hedgerows, as in England, no paving blocks as in Belgium and no snake-rail fences as in America—nothing but straight white, smooth surfaced road way along which the automobilist may make what speed he may so long as he doesn't hit anything.

Speed on European Roads.

Speed limits in continental Europe save for local option in the *agglomerations* the populated centers are in general tacitly liberal only in Britain and in Switzerland are they intolerable if one excepts the ludicrous frequency of the posting of the word *verboten* in Germany particularly in the Rhine Provinces of the Confederation.

European roads by no means cost as much as in America wages are lower to begin with and the budget is spread thin. France's ideal centralized system costs but 30,000,000 francs a year and the first classification of *Routes Nationales* little more than four thousand dollars a kilometer, with certain classes of local roads falling as low as four hundred. It is significant that road markings form as much a part of the European nationalized road systems as roadmaking. Great head stone like kilometer stones stare out at every five eighths of a mile and blue and white cast iron signboards are at *every* cross-road. In America we have depended largely upon private initiative to give us road directions with it must be confessed equivocal results, even admitting in the first instance that the intent was good.

German and Austrian roads as a whole are excellent in their main lines of communication and the mountain roads of the latter (which also has a National Touring Office which is fathering a pet project to make for the Alps of Tyrol and the Dolomites that which the automobile tourist fails to find in Switzerland) copied after the French formula run them a close second and are even more spectacular in that they frequently pass through long stretches of wildly savage country less thickly populated than Dauphiny and Savoy in old France.

Certain German roads are under particularly stringent road regulations and local taxes for upkeep and these bear on the stranger and the native alike particularly in certain localities in Wurtemburg and Bavaria but it is all in the line of progress and is therefore commendable. In the Black Forest and along the Rhine German roads reach their apogee and are in no way inferior to those of France which indeed so far as those of Alsace and Lorraine are concerned are allied to the French tradition of engineering if not of upkeep.

The frontier customs control stations of Continental Europe play a well defined part in the policing of

(Concluded on page 58.)

Will the Automobile Be Driven by Kerosene?

Problem of the Decreasing Supply of Gasoline and the Increasing Number of Internal Combustion Engines

By H. A. Morris

With 700 000 automobiles and motor trucks now in use as compared with less than 500 000 in 1911 and with tractors, motor boats, motorcycles and other gasoline burning engines increasing equally rapidly, it is interesting to note that the supply of high grade gasoline is decreasing. In fact there would have been a shortage in 1911 had it not been for the rapid development of the natural gas condensing process. This is the situation which has brought about the rise in the retail price of gasoline from 1[illegible] to 15 cents at retail and as low as 10 cents at wholesale a year ago to the present figures of 22 to 25 retail and 10 cents wholesale.

Considering too that the present season will boost the number of motor cars in use from the number mentioned to at least 850 000 while plans for 1911 show a production which will put the total beyond the million mark early this spring it really is a very grave situation, for with a falling supply of fuel there is a natural increase in its use of over 30 per cent. In 1911 the crude oil production increased but 3.5 per cent. Of this less than 10 per cent was classified as gasoline and naphtha while an additional 15 per cent was kerosene. The former totaled but 20 000 000 barrels while the kerosene added to these figures would give a total of 117 000 000 barrels.

This situation and these figures would seem to point the way out of the present dilemma, namely, the use of kerosene either as such with gasoline simply for a starting medium or mixed with the lighter fuels to make a compound which would be light and volatile enough to make starting, previously the great trouble, easy and simple.

Either one will necessitate new vaporization methods and different vaporizing devices. It will be interesting to note what has been done in this line. It will also be helpful to know what has been done with this and other heavier fuels in stationary engine practice, for good results there point out the way for future motor car success. In an extensive table published by the National Electric Light Association 29 users reported 1 oil engine each and 8, 2 each, making a total of 45 engines in 37 plants. The oil varied from 10 to 40 deg. Baumé specific gravity with the average at 28.5. The British thermal units in the fuel varied from 18 000 to 19 000, 20 showing 19 000 or more. Oil cost varied from 1.77 cents a gallon to 4 cents, 31 averaging 2.60 cents. Fuel cost a kilowatt hour for 17 varied from 0.180 to 0.501 cent and averaged 0.314 cent. Cost of horse power hour for 6 others varied from 0.181 to 0.778 cent and averaged 0.333. The total costs, including lubrication, waste and other supplies, also attendance, varied from 0.452 cent to 1.110 cent a kilowatt hour for 13 and averaged 0.708. The same on a horse power hour basis varied for 4 from 0.641 cent to 1.111 cents and averaged 0.910 cent. The power a unit varied from 75 up to 500.

This shows that heavy oils of one tenth the present cost of gasoline may be used with economy, no trouble and marked success in stationary engines. It remains only for motor car and gasoline engine builders to produce devices which will allow of using this same abundant fuel for these motors. In California stationary engine practice has been adapted to many automobiles by the simple addition of a pump, with piping and a tank, so as to spray water into the vaporizing chamber simultaneously with the admission of distillate, which is plentiful and costs about 2 cents a gallon. When this is done, the water furnishing additional oxygen for vaporization, bringing about more complete vaporization, preventing carbon deposits, softening down the explosions by producing a slower burning effect, and preventing pre-ignition, the usual cooling system is modified by the use of gaskets in the pipe connections, so that the cylinders and other parts will be kept slightly hotter (90 degrees is given as the most satisfactory figure).

In some fuel tests conducted about a year ago at the Automobile Club of America's laboratory in New York city on a standard four-cylinder automobile engine the power development on gasoline exceeded that of kerosene at 625 revolutions per minute by only 1 horse-power equal to 6.5 per cent, at 925 revolutions per minute by 1¾ horse-power equal to 8.1 per cent and at 1,210 revolutions per minute by 5.3 horse-power equal to 26.3 per cent. These tests were made without change of carburetor or any other change in the engine and would seem to show the necessity for a special vaporizing device for heavy fuels at the higher speeds where the difference shows the greatest.

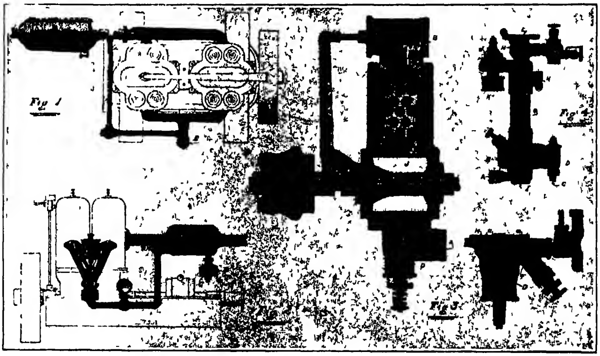
In the annual agricultural motor trials at the Winnipeg Fair, a class, increased to two classes in 1912 on account of heightened interest, is set aside for kerosene burning engines. From the 1912 results, taking engines of equal size and, where possible, of the same make, kerosene showed to advantage in nearly every direction. Thus the fuel cost of plowing an acre was lowered from 49.725 cents for 12 gasoline engines, with 64.9 as the highest and 37.3 as the lowest figure to 40.027 cents for 7 kerosene burners. The highest of the latter was 59.9 and the lowest 33.7. If this single very high figure had been eliminated in the average, the other 6 would have given 45.93 as a result. The number of horse-power-hours from a dollar's worth of fuel (the respective costs were 14½ cents for kerosene 19½ cents for gasoline as compared with 12 and 20 cents in 1912) was 73.42 using kerosene and 55.90 on gasoline. This shows to the advantage of kerosene by 31.3 per cent. In 1912, due to the difference in price, this same advantage in four selected classes was 64.2, 76.5, 42.5 and 50.4 per cent. In 1911 the figures were 27.5, 25.2, 10.9 and 74.3 per cent.

This shows that by using the fuels of lower specific gravity, commonly called heavier fuels because they weigh more, superior economy may be obtained varying from 11 to 75 per cent. Taking an average at 50, this means that with a proper vaporizing device for the heavy fuel, the owner of an automobile who got 70 miles for a dollar when burning gasoline, could change to kerosene and get 105 miles for a dollar. These figures reversed show that the cost a mile of this automobile for fuel alone would be nine tenths of a cent (0.9 cent) for kerosene as compared with 1.4 cents for gasoline.

In the main, the vaporization of kerosene is brought about by two things, a fine division of the liquid as it enters and the addition of a large amount of heat. It is preferable, experimenters tell us, to convert the chemical state, making the liquid into a fixed or permanent gas, but not all of the available vaporizers do this. The addition of the heat is usually by means of exhaust gases or jacket water or both, in many cases, the vaporizing device is actually placed in the muffler where it gets all the heat out of the exhaust gases before they are rejected into the air.

Some idea of the amount of heat necessary may be gained from the simple statement that good results cannot be obtained below 250 deg. Cent. (482 deg. Fahr.) and the best are produced at 300 deg. Cent. (572 deg. Fahr.). Two other considerations enter into the construction of the kerosene vaporizing device according to the results of the greatest experimenters, namely, accurate control of the fuel, and storage space or a device which produces flexibility. As to the former, the amount of liquid is so small as compared with the large volume of air that the latter or the gas produced must be controlled to give close and dependable results. As to the latter, starting and stopping in traffic call for a quick reduction or a storage place for gas produced in one case, and a quick acceleration of the rate of production or a storage space already filled to give the same result in the other.

Generally speaking, the devices abroad which have been successful on alcohol, benzol and other heavy fuels do very well on kerosene. Among these may be mentioned the Butler (English), Southey (English), Martha (French), Banki (Austrian), Brouhot (French), Capitaine (Italian), Longuemare (French), Merienfelde (German), Richard (French), Japy (French), Sleipner, Deutz & Koerting (German) and others, one of which is the better known Diesel engine. In may be interesting to compare the economy of the last named with a new device for using kerosene on an automobile motor brought out in England by an Italian engineer, G. Christianapolo, and called after him the G. C. This is inclosed in a muffler, so that all of the exhaust heat is used.



Kerosene and heavy oil fuel possibilities.

Fig. 1—Plan view of a four-cylinder automobile engine with universal oil converter attached. B, converter into which the exhaust gases pass in a straight flow. I, electrical admission device which governs amount of heat used in converting fuel to a gas and controls the admission of gas to cylinders.

Fig. 2—Side view of universal kerosene converter attached to a two-cylinder marine engine, where it takes the place of both carburetor and muffler. A, the converter with float at B and spray nozzle lever at C. The amount of gas and its passage is controlled by means of the lever I. This outfit is arranged for gasoline starting through the usual carburetor float chamber at G.

Fig. 3—Section through Davis (English) kerosene vaporiser acting in conjunction with a governor to give automatic control of the automobile engine. A, air inlet port. B, gas outflow port to the cylinders. C, control poppet valve. D, dashpot covering valve action. E, float chamber. F, kerosene jet. G, nozzle. H, pin to prevent the valve from turning. J, fan to break up mixture of kerosene gas and air. I, exhaust heated vaporizer for the now well diffused mixture. K, shaft driven from the motor.

Fig. 4—Sectional drawing of the Holley kerosene carbureter showing constructional features. The fuel enters at C, passing needle valve D and enters float chamber B, which is heated by exhaust gases entering at H and leaving at A. The primary air supply enters at the base at I, draws the fuel out of the spray nozzle E into vaporizing chamber F. G shows heated gas passage. Auxiliary air enters through valve J, which is prevented from fluttering by dashpot K. The completely mixed gas passes through valve M to the cylinder by the opening L. Simple mixing valve N is provided for gasoline used at starting.

(Concluded on page 51.)

Clever Devices that Help Motorists

European Inventions That Meet Real Needs

IT must be stated emphatically here that the technical refinements and auxiliaries to be described were not caused by any distrust in the ability of the cars to surmount the mountain difficulties, but by a desire to save time, trouble and possible penalties during the tour

As usual in races and reliability trials, the lubricating apparatus received the most careful attention. Almost every entrant had a little trick of his own by means of which he could increase his available oil supply, or accelerate the flow of lubricant to the parts where it was needed. Brakes and gasoline tanks also received due attention, priming apparatus and a host of unique improvements were invented and attached by the drivers themselves.

An English car, for instance, had a special rear spring suspension, shown in Fig. 1 The lowest of the horizontal leaves is fully five feet long and rotates in the center on a fixed pivot, as well as being fastened to a hinged support on the chassis frame. This construction is productive of extremely easy riding owing to the great length of the spring

In an Austrian car, shown in Fig 2, the manner of attaching the two spare wheels is unusual. The chassis frame carries a right angled iron pipe, threaded at the free end, upon which the wheels are slipped and retained by the cup *B* and the nut *S* The nut is fitted with a short handle, facilitating quick removal of the wheels. The brake adjusting device, shown in the same illustration, is the acme of simplicity, it consists of nothing but a double-threaded spindle inserted in the brake rod. To keep continuous watch over the motor a small electric lamp *L* is affixed to the dash board directly behind the engine, the whole being visible through the glass window *S* in the dashboard

An Italian car sported a queer looking radiator cap shaped like a rounded cone (Fig. 3), for the double purpose of condensing the steam rising from the radiator and preventing hot water from being carried away with the steam

Three emergency tanks were carried by a French car, illustrated in Fig 4 *B* represents the gasoline tank, *W* the extra water reservoir and *O* the emergency oil tank. The gasoline tank is of great capacity and is filled through the top of the back of front seat

The most novel, interesting and important device however, was seen on an Austrian car, shown in Figs. 6 and 7 While the arrangement of the emergency gasoline tank under the front seat is common practice, the installation of an air filter on the dashboard is a step that will be watched by every automobile manufacturer Dirt and dust carried into the carbureter through the air ports, are responsible for a large part of all the carbureter troubles and any scheme tending to eliminate this difficulty must needs command attention The filter is pictured in Fig 6, where *W* stands for the dashboard, *R* for the pipe leading to the carbureter, *S* for the permanent sieve and *T* for the easily removable linen filter, held in place by a brass ring The chief value of the device lies in the accessibility of the filter, and its removable linen sieve, which when clogged up can be replaced by a new clean one in a moment without stopping the car or the motor

One of the big German cars, outlined in Fig 5 evidently took no chances in being caught without a sufficient supply of gasoline The carbureter of this machine was of such a construction as to render the use of gasoline of different specific gravities unsatisfactory and in order to obviate this difficulty a plentiful supply of the sort of gasoline best suited to the carbureter was carried along sufficient for the entire trip The net weight of this extra supply was more than 600 pounds. *B* and *C* are pressure tanks, while *A* supplies the carbureter by gravity feed.

Fig 8 gives the arrangement of one of the many clever oil accelerators used on the tour The pump *P* forces air into *H* whence it escapes through either *A* or *B* according to the position of the two-way cocks *A* leads to the oil tank, *B* to the water reservoir The oil is not forced directly from the tank into the motor but rises first in the pipe *R* falling through a filter and the pipe *O* into the motor In Fig 8a is shown how the compressed air from the pump *P*, going through

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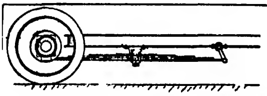


FIG. 1—A special rear spring suspension productive of extremely easy riding owing to the great length of spring

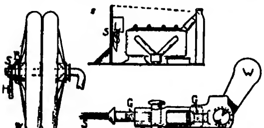


FIG. 2.—A novel way of attaching the two spare wheels.

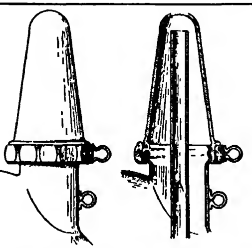


FIG 3 —This queer looking radiator cap serves the double purpose of condensing the steam rising from the radiator and preventing hot water from being carried away with the steam

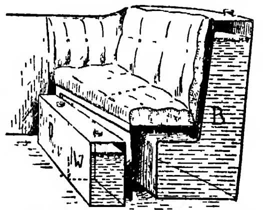


FIG 4 Three emergency tanks, of which *B* represents the gasoline tank, *W* the extra water reservoir and *O* the emergency oil tank The gasoline tank of great capacity is filled through the top of the back of the front seat

"Unpunishable infractions of the rules and regulations" one is inclined to call the little technical tricks and the refinements with which the participants in one of Europe's recent reliability runs for automobiles equipped their cars Although the aim of the tour was not to test and develop freak accessories for use on motor cars, the tourists felt the need of a little assistance in crossing the Alps during a contest Consequently they racked their brains for ways and means to increase the power, fuel capacity and lubricating facilities without transgressing the letter of the contest rules The following article, condensed from the Allgemeine Automobil Zeitung, succinctly describes the clever devices invented for the occasion —EDITOR.

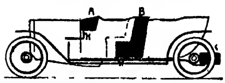
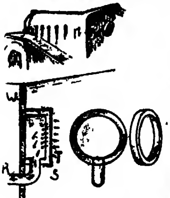
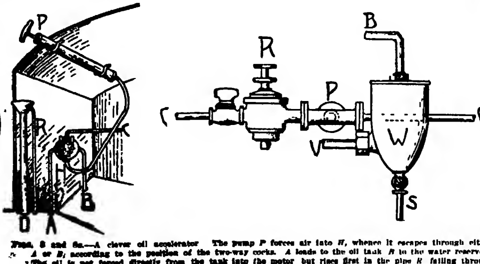


FIG. 5.—A big German car that could not operate with gasoline of different specific gravities. Sufficient fuel (600 pounds) for the entire trip was carried in pressure tanks *B* and *C* while the tank *A* supplied the carbureter by gravity feed.



FIGS. 6 and 7.—*W* is the dashboard, *R* the pipe leading to the carbureter *S* the permanent metal sieve, and *T* the removable linen filter, held by a brass ring This air filter on the dashboard prevents dirt and dust from being carried into the carbureter through the air ports



FIGS. 8 and 8a.—A clever oil accelerator The pump *P* forces air into *H*, whence it escapes through either *A* or *B*, according to the position of the two-way cocks. *A* leads to the oil tank *B* to the water reservoir The oil is not forced directly from the tank into the motor but rises first in the pipe *R* falling through a filter and the pipe *O* into the motor Fig. 8a shows how the compressed air from the pump *P* passes through the reducing valve *R* to the fuel tank, forcing gasoline into the separator *W* where it is freed from water, and then through *V* to the carbureter

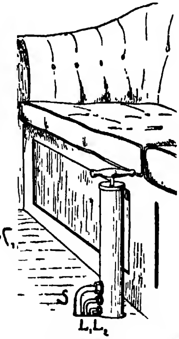


FIG 9—Another oil accelerator The pump is here located between the two front seats with three pipes *S* for suction from the oil tank L_1 for connection with the motor L_2 for the connection with the brakes

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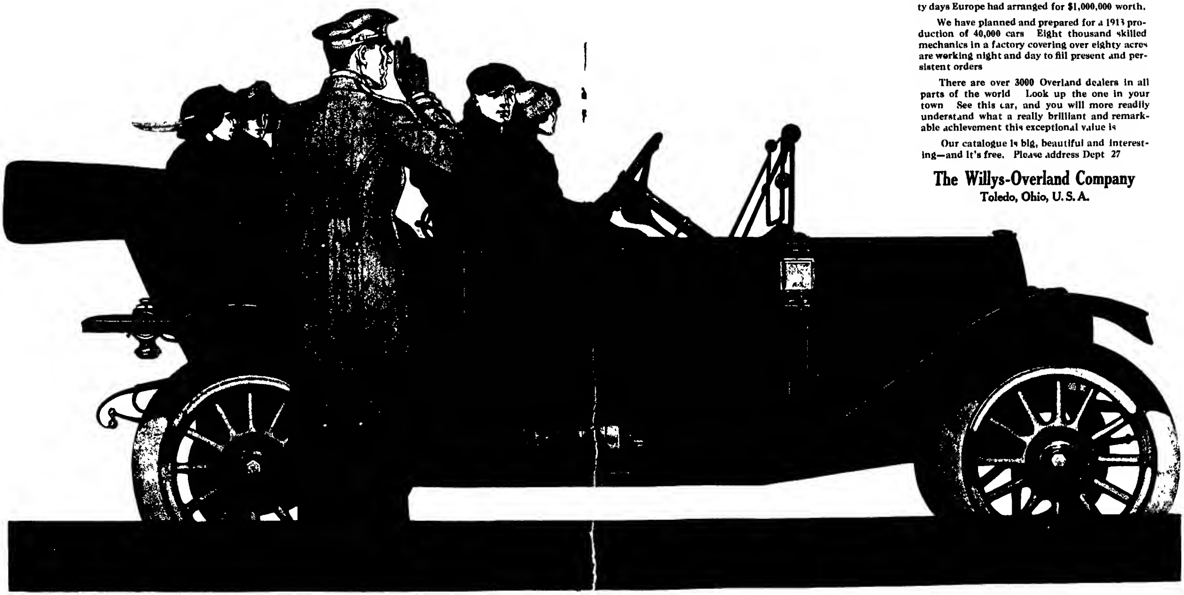

the reducing valve *R* to the fuel tank, forces gasoline into the separator *W*, where it is freed from water, and then through *V* to the carbureter

Somewhat similar is the construction shown in Fig. 9. The pump is here located between the two front seats, with three pipes *S* for suction from the oil tank, L_1 leads to the motor, and L_2 to the brakes.

A priming device which was on nearly all the cars is shown in Fig 10 It consists of nothing more than a wire protruding through the radiator and attached at the other end to an angular lever *K* is the carbureter, *S* the float stem, *H* the lever, and *D* the wire.

More ingenious is the device shown in Fig. 11, which one of the drivers employed to obtain quick adjustment of the fan belt drive, without being compelled to stop the car—the run being a non-stop contest over mountain roads. Z_1 and Z_2 are actuated by the rod *W*. *H* is firmly fastened to the sector Z_3 and carries the shaft of the rotating fan, *R* is the belt. The rod *W* is controlled by a lever on the dashboard.

Still another clever device was used by a German car, and is illustrated in Fig. 12. It consists of a wind shield having a narrow slit in the glass. The arrangement guarantees a clear view ahead even if heavy rain and mud cover the glass. Inclining the shield more or less allows each driver to adjust the height of the slit to his own requirements, by means of the usual device, shown in Fig 13.

The last two illustrations show a time-saving device, which is not unknown in this country, in connection with the easier handling of touring maps. By means of rollers and a small frame with a glass front it is possible to keep the map in full view and yet safe from being blown out of one's hand, while the entire plate and holder can be folded under the cowl dash out of the way when not in use Special ribbon like maps are used in this device

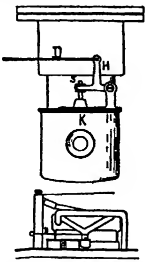

Fig. 10.—A priming device, consisting of a wire protruding through the radiator and attached at the other end to an angular lever *K* is the carbureter, *S* the float stem, *H* the lever and *D* the wire.

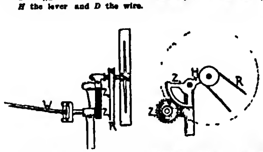

Fig. 11.—A device to obtain quick adjustment of the fan belt drive without being compelled to stop the car Z_1 and Z_2 are actuated by the rod *W* *H* is firmly fastened to the sector Z_3 and carries the shaft of the rotating fan, *R* is a belt. The rod *W* is controlled by a lever on the dashboard

Fig. 12.—A wind shield having a narrow slit in the glass thus guaranteeing a clear view ahead, even if heavy rain and mud should obscure the glass.

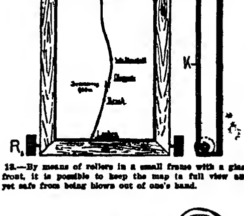

Fig. 13.—By means of rollers in a small frame with a glass front, it is possible to keep the map in full view and yet safe from being blown out of one's hand.

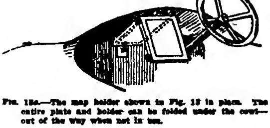

Fig. 13a.—The map holder shown in Fig. 13 in place. The entire plate and holder can be folded under the cowl—out of the way when not in use.

The Carob Bean Tree

THE carob bean is the commercial name for the ripe pods or fruit of a tree called botanically *Ceratonia siliqua* Linn of the pea family of plants. The fruit of this tree is variously known as carob, carob bean, algaroba algarroba, karoub, caroubier, locust, sweet bread, sugar pod, and St John's bread It is supposed that these seed pods are the locust and wild honey which St John found in the wilderness hence the derivation of the common name of St John's bread. The "husks" on which the prodigal son of scripture subsisted were the dry pods of the carob bean The tree is a native of the European, African and Asiatic countries bordering on the Mediterranean Sea, but it has now become naturalized in practically all localities in which oranges are grown It is a beautiful evergreen tree attaining a height of from 40 to 50 feet, and is now being cultivated very generally and plentifully in southern Europe both for shade and for the edible pods. The yield of these pods per tree is often great Some trees frequently produce as much as 800 or 900 pounds

The carob tree does not stand frost but it grows well in dry rock soil and should prove a valuable acquisition for planting in parts of the southern States. The United States Department of Agriculture, has, from time to time, propagated and distributed many hundreds of young carob trees, chiefly in Texas, Florida and in other southern States. In order to encourage its cultivation in Florida, the department propagated it in the experiment garden at Miami, Florida In response to numerous requests received from farmers and others, the station distributed seeds and cuttings, and a number of healthy young plants are now growing in the southern part of the State. This valuable tree has been tested also in southern California, and its culture doubtless, will become quite general, because there is no other tree that is likely to become more popular for shade and ornament in dry, rocky situations than the carob tree It can not only be trained into a very ornamental shade tree, but may be planted as a wind break to more tender vegetation. Its introduction into southern New Mexico and Arizona has been recommended as an important addition to the food supply for stock in those States. Occasional trees are now growing around San Antonio, Texas.

The carob trees is at present cultivated in all warm countries which suffer from periodical droughts, its long roots penetrating to a great depth in search for water It will grow in almost any kind of soil, provided it is thoroughly drained. In southern Florida it grows very rapidly on the dry shallow soil underlaid with the porous oolitic limestone. It is said to prefer limestone soil, but it will flourish on almost pure sand or on rich alluvial soil The carob tree is very common in some parts of the Canary Islands, and in 1888 was introduced to Jamaica Its introduction into the semi arid parts of Chile and Argentina has been attended with considerable success. It is grown also very extensively in South Africa, Australia, and Sandwich Islands. In all these countries the carob tree can be grown in places where no other trees will grow, notably on the dry arid regions, and it seems certain that in the endless varieties of soil and climate found in southern New Mexico and Arizona there must be many districts where it would prove very successful. The introduction of this tree would be simply invaluable to the people along the Rio Grande, especially at times when forage for their stock is scarce. Not only does the carob tree furnish food for horses, but also shade for cattle and sheep.

In practically all tropical and subtropical countries the tree is cultivated extensively for the pods which form an important article of trade. The fruit is a dark brown leathery pod of from 4 to 10 inches long and often an inch or more wide, but not over a quarter of an inch in thickness. It contains a gummy, pulpy substance of an agreeable sweet taste, which renders the pods an important article of food for the poorer classes wherever the tree grows. Although the edible portion of these pods contains about 60 per cent of sugar, it possesses very little real nutritive value, the saccharine matter belonging to the class of foods called carbonaceous, the seeds alone possess nitrogenous matter, and these are flat, hard, shining-brown, about the size of a lentil and cannot always be readily masticated. In recent years these pods have been imported into England and the United States, and have become a common article of sale in the small shops of the poorer neighborhoods of London and New York, where the children purchase them for the sake of the sweet pulp which surrounds the seeds. Large quantities of these pods have been imported into England as food for horses, and it forms one of the chief ingredients in the patent cattle foods. The value of the carob beans exported from Cyprus, an island in the Mediterranean Sea, has in some years reached over $390,000. Not only are the pods valuable, but every part of the tree is useful. The wood is hard, heavy and is very durable in contact with earth and water

The carob tree is propagated usually by seed, which is the most natural and also the easiest method. Propagation by layers, cuttings or grafting may be advisable if one wishes to be sure to grow a special variety, of which there are a number, but to make a start in carob culture it will be best to plant the seed, and other methods can be attempted later The best time to plant the seed is in August. The covering of the seed is very hard, and in order to hasten germination it is recommended to place them in hot water (not boiling) until they are softened, which may take from 2 to 10 days. When this is done the seeds should be planted at once in their permanent places. In this event, the young plants must be watered regularly and kept free from weeds until they are old enough to take care of themselves. When cuttings are used these should be prepared about 6 inches long from matured one-year-old wood in March or April. The advantage of propagating the carob tree by cuttings is that fruit bearing trees can be selected and in this way regulate the number of male and female trees. To insure the fertilization of the female flowers there should be from one to two males to every 50 female trees. Those who cultivate the carob trees in the Orient usually keep bees, because it is by means of these insects that a great many flowers are fertilized.

The distance the trees should be planted apart depends upon the local conditions, and the object of the plantation. If it is planted for a wind break, 8 feet apart will probably not be too close. In cases where it is desired to grow large trees for the fruit they produce, 30 feet each way is recommended.

Motor Trucks Articles in Next Week's Scientific American

THE subject of the automobile is now so big that it is impossible even in an enlarged issue of the Scientific American to discuss all its phases. In this number we have confined ourselves entirely to pleasure cars. Since the motor truck cannot be ignored, we will devote to it considerable space in next week's Scientific American In that issue the reader will find a general article in which the capabilities of motor trucks are graphically compared with the capabilities of horse-drawn vehicles in one of those comparative drawings which were invented by the Scientific American many years ago, and which tell their story more tellingly than words. There will also be a table of motor trucks similar to that of gasoline and electric pleasure cars to be found this issue on pages 44 and 46, but in that table motor trucks will be classified, not according to price, but according to their capacity

Preventing Oil Cloth from Cracking

A GOOD way to prevent oil cloth from cracking when used as covers for tables is as follows. A few thicknesses of paper are placed on the table and moistened thoroughly with machine oil. This will cause the oil cloth to last much longer, [illegible], and prevent cracking of the glazed surface. It should be stretched tightly over the [illegible].

No-Rim-Cut Tires
10% Oversize
By Far Outsell All Others

This Winter Tread
Will Indicate Why the Goodyear Won

Last year we sold 918,687 automobile tires.

Yet we failed to keep up with the flood-like demand by some 400,000 tires.

Seven years ago only one tire in ninety was a Goodyear tire.

Three years ago the demand was still one-twelfth as large as now.

Last year's sales by far exceeded our previous 12 years put together.

What has awakened men to Goodyear tires in this overwhelming way?

This winter tread will tell you. It shows how far we go, in every way, to multiply efficiency. To cut down tire expense.

This is only one item, but it reveals the entire Goodyear code.

Compare this tread with others, and you'll see why Goodyears won.

Note the Double Thickness

In this Non-Skid tire we add an extra tread almost as thick as the regular Thus we give you a double-thick tread

This extra tread is of very tough rubber, immensely enduring, almost impervious to wear

Because of its thickness, the blocks are deep cut. Their non-skid efficiency lasts for thousands of miles

A Bulldog Grip

These sharp-cut blocks present to the road surface countless edges and angles.

They grasp the road in every direction with a fairly irresistible grip

But the greatest advantage lies in the fact that these blocks widen out, so they meet at the base

They are not separate projections, which center the strain on a small part of the fabric They distribute the strain exactly the same as with smooth-tread tires That's the main reason why the Goodyear Non-Skid gives such exceptional mileage

Compare this tread with others.

Compare its thickness, the depth of its projections. Compare the apparent efficiency, due to these sharp-cut blocks.

Compare the way in which strains are distributed so the fabric can't be broken One glance will show you that this Non-Skid surpasses anything else of its kind About 250,000 of these treads have already been tested out.

Other Troubles Ended

Thus we have ended skidding troubles in the most effective way

Years ago we ended rim-cutting, just as completely, just as efficiently

Our patent tire—the No-Rim-Cut tire—has made rim cutting simply impossible

And that alone cut tire expense 25 per cent

Our 10 per cent oversize, under average conditions, adds 25 per cent to the tire mileage

Our fourteen years of ceaseless tests and comparisons have brought our tire quality up to the maximum

These things together, in the test of time, have placed the Goodyears on at least a quarter million cars.

One Must Respect This Verdict

Remember, please, that tire expense forms your major cost of upkeep

A tire which cuts that cost in two is something quite important

Men know when they get it in these days of odometers They know which tire serves best And the final verdict of these men who know favors Goodyear tires.

Men have tried and compared now pretty close to 2,000,000 Goodyear tires As a result the sale of these tires has doubled every year And last year's increase was 125 per cent

Now these tires by far outsell all others. And this year's output, if this increase continues, will completely equip 500,000 cars

One may easily question any maker's claims. But when hundreds of thousands of users unite, one must respect their verdict.

The verdict of experience favors Goodyear tires in an overwhelming way And every month makes the verdict more convincing

Is it not fair to suppose that your experience will bring a like result?

If you think so, get that experience Make some comparisons Settle this question by next time insisting on Goodyear No-Rim-Cut tires.

Write for the Goodyear Tire Book—14th-year edition. It tells all that we know, after fourteen years, about cutting down tire expense.

GOODYEAR
AKRON, OHIO
No-Rim-Cut Tires
With or Without Non-Skid Treads

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

Branches and Agencies in 103 Principal Cities
More Service Stations Than Any Other Tire

We Make All Kinds of Rubber Tires, Tire Accessories and Repair Outfits
Main Canadian Office, Toronto, Ont.—Canadian Factory, Bowmanville, Ont.

What Gasoline Pleasure Car Can I Buy?

A Composite Price List of American Pleasure Cars

Compiled by Theodore M R von Keler

AS long as the motor car remained a luxury for the few the question of price was a secondary consideration. Quality speed and power were the chief points which the intending purchaser considered. A few hundred dollars more or less both in first cost and in upkeep expenses, made little difference to the man desirous of possessing an automobile. Conditions have changed. It is the man of moderate means—the professional man, small merchant and fairly well to do farmer—who is the best customer of the automobile dealer. To him the question of price is usually a very essential one. With a view to assist him in a choice of cars suited to his pocketbook, the price list below has been compiled.

Because of the complexity of the undertaking the list is not complete. It does not include the manufacturer whose whole output during the past year did not reach 100 cars. It does not include every model turned out by the manufacturers listed, it does not include new models announced after January 1st, 1913. It does, however, include the leading types of cars turned out by 131 manufacturers, with prices revised up to and including January 1st, 1913. Wherever further information as to other types is desired, a request to the manufacturers will bring complete details, catalogues and specifications.

Name of Car	Name and Address of Manufacturer	Under $600	$600 to $1 000	$1 001 to $1,500	$1,501 to $2 000	$2 001 to $2 500	$2 501 to $3 000	$3 001 to $4,000	$4,001 to $5 000	Over $5,000
Abbott-Detroit	Abbott M C Co Detroit Mich.				30 rd $1 700	44 rd $2 150		44 lim $3,050		
Alco	American Locomotive Co, New York									60-t, $6,000
American	American Motors Co Indianapolis			25 rd $1 475	25 coup $2 000	32 rd-t $2 350		33 lim $3 500	50 t $4,800	50 lim 6 000
Ames	Ames M C Co Owensboro Ky				45 t $1 635	60 t $2 250				
Amplex	Amplex M C Co Mishawaka Ind								60 t $4,500	
Apperson	Apperson Bros Auto Co, Kokomo, Ind				32 t $1 600				48 t $4,200	
ArBenz	The ArBenz Car Co Chillicothe Ohio				48 t $1 750					
Atlas-Knight	Atlas Motor Car Co Springfield Mass							32 r-t $3 500		
Auburn	Auburn Auto Co Auburn Ind			26 t $1 100	32 t $1 750		41 t $3 000			
Austin	Austin Auto Co Grand Rapids Mich							45 t, $3 600	50 t $4 400	77 t $6,000
Babcock	H H Babcock Co, Watertown N Y						32 t $3 000			
Bergdoll	Louis J Bergdoll M Co Philadelphia Pa			26 rd $1,500	40 t $2 000	40 t 5 p $2 400				
Berkshire	Berkshire Motors Co Pittsfield Mass						37 t $3 000	40 t $4 000		
Buick	Buick Motor Co Flint Mich		28 rd-t $950	32 rd-t $1 125	40 t $1 650					
Cadillac	Cadillac M C Co Detroit Mich				50 t-rd $1 975	50 coupé $2,500		50 lim $3 250		
Case	J I Case Motor Works Racine Wis			30 2p rd $1 500		40 t 5 p $2 200		40 lim $3 200		
Cameron	Cameron Car Co Beverly Mass		24 t $975	37 t $1,400						
Carhartt	Carhartt Auto Corp Detroit Mich			27 r-t $1 350						
Cartercar	Cartercar Co Pontiac, Mich				5A t 5p $1 700					
Chadwick	Chadwick Eng Wks Pottstown, Pa.									60 rd-t $5 500
Chalmers	Chalmers Motor Co Detroit, Mich				36 rd-t $1 950	54 rd t $2 400	54 t 7p, $3 000			
Cino	Haberer & Co Cincinnati O						38 t $2,750			
Cole	Cole Motor Car Co Indianapolis Ind				40 rd-t $1 685	60 rd-t $2 485				
Columbia-Knight	Columbia M C Co Hartford Conn								38 t $4 500	
Crow	Crow M C Co Elkhart Ind			43 rd $1 200	32 t $1 750		60 t $1 000			
Croxton	Croxton M C Co Washington Pa					40 r t $2 500	48 t $3 000			
Cunningham	Jas Cunningham Son & Co Rochester N Y							36 t $3 500		
Cutting	Cutting M C Co Jackson Mich			40 rd t $1 475						
Day Utility	Day Auto Co Detroit Mich			43 t $1 500						
Davis	G W Davis Co Richmond Ind				3-40r rd-t $2000	50 t $2 100				
Detroiter	Briggs-Detroiter Co Detroit Mich		25 rd-t $850							
Duryea	Duryea Motor Car Co Saginaw Mich	Motor buggy prices on application								
Empire	Empire Automobile Co Indianapolis Ind		20 rd $750							
Enger	The Enger M C Co Cincinnati Ohio			40 rd-t $1 475	40 rd t $1 750					
Fiat	F I A T Poughkeepsie N Y							35 t $4 000	50 Six $5 000	
Firestone-Columbus	Columbus Buggy Co Columbus O	Roadsters Touring Cars 4-cyl 30 t and 40 t and 6-cyl 58 t (prices on application)								
Flanders Sixes	Flanders Motor Co Detroit Mich				40 t $1 550	50 t $2,250				
Ford	Ford Motor Co, Detroit Mich	22 r $525	22 t $600							
Franklin	H H Franklin Mfg Co Syracuse N Y				18 r $1 650		30 t $2 900	38 t $3 600	38 lim $4,850	
Garford	The Garford Co Elyria O						6-cyl t $2 750	6 cyl lim $3 750		
Glide	Bartholomew Co Peoria Ill				40 t $1 690	45 t $2 250				
Grant	Grant M C Co Cleveland O						50 rd-t, $2 750			
Great Western	Great Western Auto Co Peru Ind				40 rd t $1 585					
Grout	Grout Auto Co, Orange Mass				32 t $2 000		36 t $2 850			
Halladay	Streator M C Co Streator Ill			23 t $1 100			33 rd $2 750			
Havers	Havers M C Co Port Huron Mich				44 rd t $1 850	55 rd-t, $2 250				
Haynes	Haynes Auto Co Kokomo Ind				2 t 5p $1 785	40 rd t $2 250		40 lim $3 400		
Henderson	Henderson M C Co Indianapolis Ind			45 rd t $1 485	45 rd t $1 585					
Herreshoff	Herreshoff Motor Co Detroit, Mich			30 rd $1 250	36 t $1 850					
Hudson	Hudson M C Co, Detroit Mich.				17 rd-t $1 875	54 t $2 450				
Hupmobile	Hupp M C Co Detroit Mich		20 r $750	6p t $1 175						
Imperial	Imperial Auto Co Jackson Mich			40 t $1 285	45 t $1 650					
Inter State	Inter-State Auto Co Muncie Ind				12 rd t $1 700	40 rd t $2 400		50 rd-t $3 400		
Jackson	Jackson Auto Co Jackson Mich			35 t $1 500	45 t $1 975	55 t $2 500				
Keeton	Keeton M Co Detroit Mich						48 Six $2750			
Kelsey	Kelsey Car Corporation Connersville Ind					Six t, $2 375				
King	King M C Co Detroit Mich			33 rd t $1 100						
Kissel Kar	Kissel M C Co Hartford Wis				30 t rd $1 700	50 t $2 500		60 t rd $3 150	60 lim $4 000	
Kline Kar	Kline M C Corp Richmond Va				30 rd t $1 850	40 rd-t $2 250	30 rd-t $2,850	60 rd-t $3 250		
Knox	Knox Auto Co Springfield Mass								60 t $5 000	
K-R-I-T	Krit M C Co Detroit Mich		25 rd-t $900							
Lambert	Buckeye Mfg Co Anderson Ind			27 rd t $1 200	35 t $1 650					
Lenox	Lenox M C Co Boston Mass				40 rd t $2 000		60 t $2 750			
Little Four	Little M C Co Flint Mich		20 rd $750							
Locomobile	Locomobile Co Bridgeport, Conn							41 rd-t $4 000	60 rd-t $4 300	82 lim $6 000
Lozier	Lozier M C Co Detroit Mich							52 t r $3,200	88 t rd $5 000	88 lim $6 500
McFarlan Six	McFarlan M C Co Connersville Ind					45 rd-t $2 300	60 t $2 750	50 rd t $3 700		
McIntyre	McIntyre Co Auburn Ind			20 t $1 125						
Marathon	Marathon M Wks Nashville Tenn		25 rd $875	35 t $1 350	15 t $1 750					
Marion	Marion M C Co Indianapolis Ind			30-40 t $1 475	18 t $1 850					
Marmon	Nordyke & Marmon Co Indianapolis Ind						32 t-r-lim, $3000		48 t r lim $5 000	
Matheson	Matheson Auto Co Wilkesbarre Pa								50 t 5-7p $4 800	
Maxwell	Maxwell Briscoe Co Tarrytown N Y		22 rd $785	30 t $1 115	40 t $1 675					
Mercer	Mercer Auto Co Trenton N J						32 t $2 600			
Metz	Metz Co Waltham Mass	22 rd $[illegible]	22 rd $605							
Michigan	Michigan M C Co Kalamazoo Mich				40 rd-t $1 585					
Midland	Midland M Co Moline Ill				32 t $2 000					
Mitchell	Mitchell-Lewis M Co Racine Wis			40 rd t $1 500	50 rd-t $1 850	60 t $2 500				
Moline	Moline Auto Co East Moline Ill				40 rd-t $1 950					
Moon	Moon M C Co St Louis Mo			30 r rd t $1 485	38 r rd t $1 985	65 r rd t $2 500				
Moyer	H A Moyer Syracuse N Y					12 t $2 500	40 t $3 000			
National	National M Veh Co Indianapolis Ind						40 rd $2 750			
Norwalk	Norwalk M C Co Martinsburg W Va							Six t $3 100		
Nyberg	Nyberg Auto Wks Anderson Ind			47 t $1 295	15 t $1 750					
Oakland	Oakland M C Co Pontiac Mich		15 rd $1 000	40 t $1 450	12 rd t $1 600	60 rd t $2 400	60 lim $3 000			
Ohio	Crescent M C Co Cincinnati O					25 rd-t $2 500				
Oldsmobile	Olds Motor Wks Lansing Mich					36 rd-t $2 500		40 t $1 200	60 rd t $5 000	60 lim $6 000
Overland	Willys-Overland Co Toledo O		30 t $985							
Packard	Packard M C Co Detroit Mich		25 r rd $[illegible]				18 t $2 800	30 t $3 700	48 t $4,850	48 lim $5,850
Paige-Detroit	Paige-Detroit M C Co Detroit Mich			30 r rd $1 275						
Palmer Singer	Palmer & Singer Mfg Co Long Island City				45 rd-t $2 000		60 rd t $3 000			
Pathfinder	Motor Car Mfg Co Indianapolis Ind					40 rd t $2 185				
Patterson	W A Patterson Co Flint Mich			35 t $1 250	27 t $1 800					
Peerless	Peerless M C Co Cleveland O								48 t $4 300	60 t $6 000
Penn	Penn M C Co New Castle Pa		22 rd $1 000	27 t $1 400						
Perfex	Perfex Co Los Angeles Cal			30 rd $1 050						
Petrel	Petrel M C Co Milwaukee Wis		22 rd $950	30 t $1025-$1,300						
Pierce-Arrow	Pierce-Arrow M C Co Buffalo N Y								38 t $4,300	66 t $6 000
Pilot	Pilot Car Sales Co Richmond Ind				53 t $2 000	59 t $2 250				
Pope-Hartford	Pope Mfg Co, Hartford Conn					40 rd-t $2 250		50 rd t $3 250	60 rd-t $4 250	60 lim $5 550
Pratt	Elkhart Carr & H Mfg Co Elkhart Ind				42 r t $2 000					
Premier	Premier Motor Mfg Co Indianapolis Ind						[illegible] 6 rd-t $2785	Big 6 rd-t $4000		
Pullman	Pullman Motor Car Co York Pa				36 rd $1 675	44 rd $2 150	56 rd $2 750			
R C H	R-C-H Corporation Detroit Mich		25 rd-t $900	25 coup $1 300						
Rayfield	Rayfield M C Co, Springfield Ill					41 rd-t $2 500				
Rambler	T B Jeffery Co Kenosha Wis				42 t $1 875		42 lim $2 825			
Raymond	Raymond Eng Co Hudson, Mass	22 r $445								
Regal	Regal M C Co Detroit Mich		25 t $900	25 t $1 400						
Reo	Reo M C Co Lansing Mich			35 rd-t $1 095						
Republic	Republic M C Co Hamilton O					35 rd-t $2,350				
Schacht	Schacht M C Co Cincinnati O				45 t-r $1 850					
Sebring	Sebring M C Co Sebring O						30 t $2 750			
Selden	Selden M Veh Co Rochester N Y					36 rd-t $2 500	36 t, $2 750	36 lim $3 750		
Simplex	Simplex Auto Co New York City									50 t, $6,200
Speedwell	Speedwell M C Co Dayton O						40 t $2,700			
Spaulding	Spaulding Mfg Co Grinnell Iowa				30 t $1,650					
Stanley (steam)	Stanley M Carriage Co Newton Mass.			10 4p t $1 400	20 t $1 700	30 t $2 500				
Staver	Staver Carriage Co, Chicago Ill				45 t $1,875	55 t $2 250	65 t $2 750			
Stearns	F B Stearns Co, Cleveland O								30 t, $4 750	30 lim $5 750
Stevens-Duryea	Stevens-Duryea Co, Chicopee Falls Mass								rd-t, $4,800	30 lim, $5,800
Stoddard Dayton	Dayton M C Co Dayton O			30 t $1 450	35 t $1,850		48 t $2,800		Knight, $6,000	
Studebaker	Studebaker Corp Detroit Mich		25 t $885	30 t $1 100	40 t 6-cyl $1 550					
Stutz	Ideal M C Co Indianapolis Ind				50 rd-t $2 000	60 t $2,300				
S G V	S G V Co Reading, Pa					25 t-r $2 500		35 t $3,600		
Vaughan	The Vaughan Car Co Inc Kingston, N Y							25 t $3 600		
Velie	Velie M Veh Co Moline Ill			32 rd-t, $1,500	40 t $2 000	40 t $2,500	40 lim $3 000			
Warren	Warren M C Co Detroit, Mich			30 t $1,300	35 t $1,800					
Westcott	Westcott M C Co Richmond Ind					23 t, $2,250		29 t $3,300		
White	The White Co Cleveland O				30 t $2,500			40 t $3 500	30 lim, $4 050	60-6 c. t 6,300
Winton	Winton M C Co Cleveland O						48 r-t $3 000	7 pas. t, $3,250	48 lim, $4,500	
Zimmerman	Zimmerman Mfg Co Auburn Ind			34 rd-t, $1,500	6 cyl rd-t, $2000					

Abbreviations used in the list.—Runabout, *r*, Roadster *rd*, Touring Car *t*, Limousine, *lim* Horsepower expressed by numeral giving the brake horse-power. Combinations such as *r-rd-t* signify that all three types sell at the same price.

What Electric Pleasure Car Can I Buy?

A Table Which Gives the Name, Manufacturer and Price of the Principal American Electric Pleasure Cars

Name of Car	Name and Address of Manufacturer	Under $2,500.	$2,500 to $3,000.	Over $3,000.
Argo	Argo Electric Vehicle Company, Saginaw Mich		4p Rd $2,500 4p Bro. $2,900	Fore-Drive 5p $3,100
Bailey	S R Bailey & Co. Amesbury Mass.	2p Roadster $2 250-$2,500	Phaeton, $2 600	4p Roadster, $3 200
Baker	Baker Motor Vehicle Company, Cleveland, Ohio	2p Victoria, $2,000	4p Coupé, $2,800	Brougham, $3 100
Borland	Borland-Grannis Company Chicago, Ill	5p Brougham $2 500	3p Rd $2,500 5p Coupé $2,900	7p Limousine, $5,500
Broc	Broc Electric Vehicle Company, Cleveland, Ohio	2p Stanhope $2 000 Vic 2p 2 050	5p Brougham, $3 000	6p Brougham $3 300
Buffalo	Buffalo Electric Vehicle Company, Buffalo, N Y		2p Roadster $2 600	5p Coupé $3 200
Century	Century Electric Car Company Detroit, Mich		5p Brougham, $2,550	
Chicago	Chicago Electric Motor Car Company, Chicago, Ill		131 Coupé, $2,800	132 Coupé, $3,100
Church Field	Church-Field Motor Company Detroit, Mich	2p Roadster $3 300	Brougham $2,800	
Colonial	Colonial Electric Car Company, Detroit, Mich		5p Brougham, $2,700	
Columbus	Columbus Buggy Company Columbus, Ohio			
Dayton	Dayton Electric Car Company Dayton, Ohio	2p Victoria, $2 100	4p Coupé $2 700	
Detroit Electric	Anderson Electric Car Company Detroit, Mich	2p Roadster $2 350, Vic $2 300	4-5p Brougham $3 000	5p. C V Brougham $3 600
Flanders	Flanders Manufacturing Company, Pontiac, Mich	4p Victoria, $2 250	4p Coupé $2,500	
Fritchle	Fritchle Auto and Battery Company Denver, Colo	2p Roadster $2,100	4p Touring, $2,500	4p Coupé, $3 600
Grinnell	Grinnell Electric Car Company, Detroit, Mich		5p Coupé $2,950 Broug m $3 000.	
Kimball	C P Kimball & Co. Chicago, Ill.		2p Phaeton, $3,000	
Ohio	Ohio Electric Car Company, Toledo, Ohio	3p Victoria $2,300	5p Coupé $2 900	5p Brougham $3 200 and $3,500
Hupp-Yeats	R-C-H Corporation, Detroit, Mich.	4p Regent, $1,750		
Rauch & Lang	Rauch & Lang Carriage Company Cleveland Ohio	4p Victoria, $2 500	4p Coupé, $2 900 5p Bro. $3 000	
Standard Electrique	Standard Electric Carriage Company Jackson Mich	4p Coupé, $1,885	5p Coupé, $2,250	
Studebaker	Studebaker Corporation South Bend Ind	17 Stanhope, $850		
Van Wagoner	Clark Motor Carriage Company Buffalo, N Y	2p Roadster $1,800	Coupé, $2,200	5p Coupé $3 000
Waverley	The Waverley Company Indianapolis, Ind	2p Roadster $2 250		5p Limousine, $3 500
Woods	Woods Motor Vehicle Company Chicago, Ill	2p Rd $2 400 4p Vic $2 500	5p Brougham $2,700	4p Lim $3 100 5p Lim $3 600

The Trend in Automobile Construction

The Views of Automobile Engineers and Designers

Some weeks ago the Editor of the SCIENTIFIC AMERICAN *sent out a letter to the members of the Society of Automobile Engineers in which they were asked to give their views on present tendencies in automobile design. Through lack of space it is impossible to publish all the replies received. Moreover, automobile engineers are fairly well agreed on the present tendencies, so that there would be considerable repetition were all the replies printed. It has been deemed advisable to select from the many letters received those which seem to express the views of most designers. In this selection subject matter has been considered rather than the personality of the writer. More replies appear in the current issue of the* SCIENTIFIC AMERICAN SUPPLEMENT.—EDITOR.

We believe present tendencies in design and construction are for smaller motors, higher speed and more efficiency than found in the present type of motor motors that would compare with the better design of motors on the other side, small high speed, highly efficient motors are used. This seems to be a vital subject, as the price of gasoline is steadily going up and therefore the economy must be closely watched. Also there is a very strong demand for automobiles using a high grade of kerosene or a low grade of gasoline and this is something that must be met and handled by the engine builders as well as the carburetor manufacturers.

GEORGE T BRIGGS
Indianapolis Wheeler & Schebler.

The electric starter is giving the engineer considerable concern. The electric starter must be reliable, self controlled and above all fool proof. It must be large enough to crank the motor rapidly and yet as small as possible in order to keep down weight. The charging and lighting dynamo, whether it be one unit with the starting motor or a separate machine must have sufficient capacity to keep the battery fully charged at all times, and must of course be small enough to keep down weight. It becomes evident then that the ideal electric equipment is the combination of the charging dynamo with the starting motor in one unit, thus giving one half the added weight.

CHARLES BRYDEN *Chief Engineer*,
Indianapolis, Ind American Motors Company

The automobile manufacturer is giving his careful attention to the public demands for a comfortable noiseless car, particular attention being given to self starter, the tendency being in favor of the electric self starter.

The manufacturer to-day is giving greater attention to the analysis of metal used and in most instances specifies his own analysis as he has learned by practical experience that certain analyses give better results for his particular kind of work.

P J IMOATE,
Detroit Mich Heinze Electric Company

First of all the present tendencies in the design of engines is in the application of the long stroke and some type of piston or sleeve valve to replace the poppet types. In regard to the design of carburetors, which is, of course an other important problem that confronts automobile engineers most strongly is the adaptation of present successful types to operation with kerosene or at least liquid fuels heavier than gasoline. Variations in the design of the valves are however very insignificant in comparison with remodeling of the carburetors for automobile engines. This tendency is observed on every hand by the widespread interest in all sorts of devices being proposed for using heavier liquid fuels and by the improvements made in most of the 1913 models of carburetors for heating the mixing chamber either with the hot water from the jackets or with the exhaust gases.

J A MOYER,
Professor of Mechanical Engineering,
State College Pa Pennsylvania State College.

The most vital problem to-day in the gasoline automobile is the necessity of being able to burn the poor grades of fuel. The greatest want to-day is the ability to burn kerosene successfully in the present automobile engine. The most serious problem to-day is the lack of gasoline. 1913 and 1914 will be more serious in this respect than at present.

H S HOMMY
Waukesha Wis. Waukesha Motor Company

One of the problems that seems of great and almost imperative importance and in which the requirements for a solution are continually becoming more pressing is, of course, the carburetor and fuel supply.

The difficulties are known but the incentive to remedy them does not seem to be sufficient. Many data are required before the engineer may command this subject. The data are wanting. The defects are known but the remedies not. The law of diffusion of vapors is but little understood, and if it were understood, the engineer does not know what sort of vapors he is dealing with. The relations between the carburetor and the motor and different speeds of the motor length of the intake pipe and such matters have not been thoroughly investigated.

Detroit, Mich E. J STODDARD

The present day demands of the owner driver in the order of their importance are as follows: Electric lighting self starting motor magneto ignition extreme quietness at all speeds, flexibility of control maximum ease alighting from driver's seat, convenience of minor controls, ability to completely lock up car, liberal oil storage for hundreds of miles of running.

Accessories.—Top capable of raising and lowering without help and curtains lowered from within. Glass front adjustable from completely lowered to rain vision. Demountable rims with extra rims, casings and tubes.

Chicago, Ill. R. M NEWBOLD.

From the manufacturers standpoint, the present tendencies in design and construction may best be summed up as developing along two lines (*a*) the more economical use of material (*b*) the more economical distribution of material.

By the more economical use of material we mean the use of such special alloys or specially treated materials as shall produce a car which is more durable, requires less attention and weighs less for a given carrying capacity. By the more economical distribution of material, we mean the careful study of design in every part of the car in order that the best material for any particular part shall be used in that part, that no more shall be used than is requisite to have it perform its due and proper functions.

A P BRUSH, *Consulting Engineer*,
Flint, Mich. General Motors Company

As to present tendencies in carburetor design, in Europe they have done away with the spring air valve and alt have all the air entering past the point of fuel flow. This tendency is being widely felt in this country and the makers are gradually coming to this type.

The public are demanding carburetors which start easier and keep on running even after motor and carburetor are very cold.

GEORGE M HOLLEY *President*,
Detroit, Mich. Holley Brothers Company

The latest field for experiment on the part of the engineering department is demountable wire wheels. It is the writer's opinion, however, that this foreign feature will eventually consist of non-demountable wire wheels, fitted with demountable rims for quick detachable tires, because the expense of additional spare wheels, as well as the weight, more than compensates for the advantages resulting from the use of wire wheels.

Among the advantages of wire wheels compared with wood or pressed steel wheels, are increased tire wear, due to the resiliency of wire wheels, and improved appearance of the car. The subject of braking all four wheels has been discussed a number of times by American engineers, but has not found favor in this country and is losing favor abroad.

Relative to bodies, the growing tendency is for straight line flush side construction with a stream line effect in order to reduce wind resistance to a minimum.

New York, N Y JOSEPH A ANGLADA.

I feel that the present tendencies in design and construction, if left to the manufacturer would be simplification of parts and ease of assembly. The demands of the public, however preclude the possibility of working very far in this direction.

There seems to be a tendency to use wire wheels. I hardly think that the demand for this, however is caused by any trouble that the wood wheel has given but it is due more to a desire for something newer. It is a fact however, that some of the larger concerns in England are putting more than half of their product on wire wheels.

C A TRASK (Per R. P), *Assistant General Manager*,
Indianapolis. Henderson Motor Car Company

It seems to me that the most vital problems are the development of engines and carburetors to use kerosene and alcohol successfully, a simple and successful substitute for the poppet valve, the proper design and lubrication of small bearings and linkage joints.

It seems to me that with the substitution of a simple and successful sleeve or rotary valve, the addition of means for using a heavy fuel, and adequate protection and lubrication for small wearing parts, the present moderate-priced machines would be all that could be desired.

D W SMITH, *Member S A E*,
Washington D C Brock, Recken & Smith.

The present tendencies in design and construction are toward quietness, simplicity of arrangement of parts, luxuriousness and electrical improvements.

The public demand is for higher powered cars, 6 cylinders, electric lighting, easy riding, full equipment and accessibility.

The demands of the public must be met by decrease in the cost of production without sacrificing the quality of the cars produced, better design from the standpoint of the engineer, reduction of selling costs and standardization of certain parts.

The vital problems in automobile construction are those affecting the maintenance of the car such as carburetors, transmission gearing, lubrication and tires.

Every concern should pay special attention to the establishment and maintaining of a properly equipped laboratory under the supervision of an engineer who has been thoroughly trained in the theory and practice of motor car construction, both at home and abroad.

W C MARSHALL,
Assistant Professor of Machine Design,
Sheffield Scientific School of Yale University
New Haven, Conn.

The tendency of the automobile construction at the present time, appears to be the substitution of spline shafts for square shafts in transmission boxes. This is desirable, in a general way provided the making of the shaft and the gear is carried out on correct lines, that is, the spline shaft should be made so that the surfaces between the splines run true with the bearings, and then the hole in the gear could be ground to proper diameter to fit this shaft at its smallest diameter and accurate results can be obtained.

There is a tendency among some of the manufacturers to have the gear make contact on the tops of the splines, because this surface can be easily machined by putting the shaft in a plain grinder and grinding the tops of the splines after the shaft has been hardened or heat-treated.

The ideal way, we believe, is to finish the spline shafts accurately between the splines either by a second milling operation or by a grinding operation, and then design the gear to fit on this surface and not fit on the tops of the splines. By so doing, the gear can be ground to accurate diameter on an internal grinding machine and perfect fits are sure, together with accurate workmanship and quiet running operation.

JAMES N. HEALD,
Worcester, Mass. The Heald Machine Company.

An Ingenious Overheating Tell-tale

ALTHOUGH the automobile motor admittedly is a heat engine, and as such requires to operate at temperatures which under ordinary conditions would be considered comparatively high, it still is essential that this temperature be controlled within well-defined limits if the motor is to operate at its maximum efficiency

In other words, the amount of heat that is dissipated, or, figuratively speaking, lost, determines the thermal efficiency of the motor If the motor runs too cool, its efficiency will be low, as will be directly visible in the increased amount of fuel required to generate a given amount of power Theoretically, its thermal efficiency will increase in proportion to the temperature rise up to a certain limit when the permissible co-efficient of expansion of the metal parts is reached when there is danger that the pistons will 'freeze" in the cylinders and cause damage that is costly if not irreparable. Needless to add, motors are particularly susceptible to danger of the kind during the summer season

As a rule, the water cooling system can be relied upon absolutely to maintain a motor at the proper temperature for the best all around results. There are conditions, however, as when making long climbs on low gear, for instance, when the temperature rise may be abnormal Also, a broken fan belt, of which the driver may have no knowledge, or a short age of water in the radiator, may cause excessive heat

To give the driver instant and visible evidence of such conditions, an ingenious radiator thermometer has been developed and recently placed on the market. In its simplest aspect, it consists of a short thermometer tube containing bright red liquid mounted on a short scale with wide plainly marked divisions. At the upper end of the scale, between the divisions 130 and 212 deg Fahr., there is a round aperture the purpose of which is to permit the driver to see the red fluid instantly it mounts higher than the division corresponding to a temperature of 130 degrees. At approximately 180 degrees, which is the normal operating temperature of the average motor, there are two arrows, one on either side of the scale, so arranged that the driver is made instantly acquainted with further temperature rises, which may be taken as an indication of improper driving or derangement in the cooling system.

The device is calculated to detect leaky radiators, water shortage loose or broken fan belts, faulty lubrication, etc., all of which are conducive to over heating In cidentally, it should prove valuable in increasing fuel economy, for it is comparatively well known that very few motors are operated on the minimum amount of fuel, rich mixtures are one of the most prolific causes of excessive temperature rises.

The thermometer scale registers, also, down to the freezing point of water, and the instrument, therefore, should be useful in obviating the conditions which otherwise would result in the cooling system freezing up in cold weather With its aid, the driver is enabled to tell at a glance just when to throw his robe over the radiator while waiting for passengers, or, instead of permitting his motor to run idly for long periods, thus reducing fuel economy, he can stop it until the temperature of the water as indicated by the instrument, becomes low enough for the motor to be started and run for a short time to heat the water above the danger point again.

The device can be attached to any motor merely by drilling a three eighths inch hole in the radiator cap and inserting the stem of the device through it.

The Automobile Bus in Europe

IN various parts of Europe the use of the autobus for passenger service is on the increase. We note that in Greece the government wishes to have the public service running as soon as possible between Tripolitza and Sparta and between Lamia and Karpenissos. In Paris the

INQUIRY COLUMN

Inquiry No 9291 Want to buy machinery for manufacturing wooden tooth picks.

Inquiry No. 9292 Wanted a gum that will stick labels to grape-fruit

Inquiry No. 9293 Wanted the names and addresses of manufacturers of waterproof cloth, also samples of such cloth

Inquiry No. 9294 Wanted to buy glass balls 1¼ x 1¼" in diameter

General Omnibus Company is now finishing the entire change-over, and the last of the double-deck horse vehicles are now disappearing. The figures for the last week of July showed 2,155 autobus running regularly in London, and 800 of these were put in use since the first of the year. The company is beginning to use several autobus of a new type for special service on renting by private parties, containing 27 or 34 places, and they are now running a new line which ends at Windsor, covering 12 miles in 1 hour and 18 minutes.

The New Vienna Museum of Technology and the Industrial Arts

THE first general assembly of the "Technisches Museum fuer Industrie und Gewerbe in Wien" met in the municipal council chamber of Vienna on December 1st. The meeting was attended by many manufacturers, scientists, technicians, financiers and public officials, whose interest in the new foundation had drawn them to the capital from all parts of the Austro-Hungarian empire.

The nature, purpose, preliminary history and present condition of the museum may be gathered from the addresses made by various speakers, including Arthur Krupp, chairman of the working committee which has had the affairs of the museum in its charge.

Herr Krupp, in his opening address, reminded his hearers that the Museum had been planned as a permanent memorial of the Jubilee Exposition held in Vienna in 1908, and that the establishment of such a museum had been suggested in 1907 by Dr. Brosche then attached to the ministry of commerce, for the purpose of stimulating interest in the projected exposition, which appeared to be in danger of failure. The great industrial companies and firms adopted the suggestion with enthusiasm, and a working committee was formed to take charge of the preliminary work. The Imperial government granted the museum a subvention of 1 500 000 kronen ($305,000) and agreed to incorporate with it a number of important government collections. The city of Vienna contributed a suitable building site and a large sum of money.

The Imperial minister of commerce, after referring to the importance of technical progress for natural prosperity and the rapid and continuous transformation of industrial methods by the application of new advances in science and technology welcomed the museum especially as an evidence of the part pledged in these advances by Austrian investigators—a part often underestimated even in their own country. The speaker claimed the invention of the screw propeller for the Austrian inventor, Ressel. He then spoke of the educational value of the museum, in which the progress of an invention can be followed from its crude beginning to its finished and practical form. Here the curious visitor and the embryo inventor will see the original Bell telephone beside the newest and most convenient desk instrument, the feeble little locomotive of old beside the latest, swiftest and most powerful giant of the rail, etc. The minister of commerce praised the generosity of the city of Vienna which had given a million kronen and land worth another million, and the 800 firms and individuals who had contributed more than two million kronen, this increasing the total endowment to 4.6 million kronen ($934,000). The government had chosen eminent men as its representatives in the boards of directors and curators, and had appointed Herr Arthur Krupp president of the board of curators.

President Krupp, before moving to proceed to the election of curators, stated that the universities, technical schools and scientific societies would have special representatives on the board, and that the general association of the museum already numbered 1,050 members.

The museum building is nearly completed, and the work of interior arrangement, equipment and installation of collections will probably be completed within a few months.

Will the Automobile be Driven by Kerosene?

(Concluded from page 51)

The test showed the following figures

	Consumption in pints	Cost cents a pint	Horse-power cost, cents
Gasoline engine			
Fuel	0 70	1 372	1 067
Oil	0 09	8 375	0 203
			1 260
Diesel engine			
Fuel	0 80	0 508	0 366
Oil	0 08	8 375	0 305
			0 671
Automobile engine Kerosene (G C device)			
Fuel	0 65	0 627	0 488
Oil	0 018	8 375	0 183
			0 671

Among the devices made in America which have proven successful, mention must be made of the Universal, Holley, Hart-Parr (tractor), Twombly, International Harvester (tractor) Rumely (tractor), Gas Traction (tractor) Mietz & Weiss (stationary), Hornby Ackroyd Dehi Vergne (stationary) A number are still in the experimental state

In his experiments, Mr Holley has found that a Ford car fitted with his device will give 28 miles a gallon on kerosene and 32 on gasoline as bought at random in Detroit. This is a per mile cost of 0.35 cent for kerosene and 0.6 cent for gasoline (based on 10 and 20 cents) Mr Holley states as a result of several years experimentation in this line that he believes "the kerosene carburetor will be used largely in the commercial line, such as delivery wagons, motor trucks and commercial boats at an early date. As to motorcycles and pleasure vehicles, it has a future but gasoline will be used for a considerable period"

The makers of the Universal state in their guarantee that "The device will give a greater range of speed control than cold gasoline and a range equal to heated gasoline, that it will give from 10 to 15 per cent more power a pound of fuel on kerosene than on gasoline, and back up both claims

These instructions and the foregoing seem to show that there is a big future in kerosene as an automobile or internal combustion engine fuel, and that its use is not far away, nor will it entail any great amount of change in existing motors, other than the substitution of a suitable vaporizer

TABLE OF COMPARATIVE KEROSENE AND GASOLINE RESULTS TAKEN FROM WINNIPEG AGRICULTURAL TRIALS 1912

Fuel Make, Entry Number Class, Type and Size Engine Plows, Mileage Traveled	Fuel in Pounds	Cost of Fuel an Acre Plowed	2-Hour Brake Test: Average BHP	Fuel in Pounds	Cost in Cents—Fuel—BHP. Hour	HP-Hours of a Gallon of Fuel	HP-Hours of $1 00 Worth of Fuel
Kerosene—Avery 19 D 2-cylinder 7 75" bore, 8" stroke 4 Avery 14" plows, 6 miles	108 0 K 3 0 G	$0 584	27 50	41 5	1 386	10 47	72 3
Gasoline—Avery 3 B, 2-cylinder, 7 75" bore, 8" stroke, 4 and 5 Avery 14" plows, 6 miles	65 5	0 468	25 87	32 75	1 763	11 02	80 7
Favors Kerosene by per cent		19 85	5 78	—22 1	27 2	— 5 34	27 5
Kerosene—IHC 21 E, 2-cylinder, 9 5" bore, 12" stroke 8 P & O 14" plows, 6 miles	171 5 K 1 0 G	$0 474	48 90	75 5	1 430	10 22	70 5
Gasoline—IHC 9 C 2-cylinder, 9 5" bore, 12" stroke 8 Oliver, 14" plows, 6 miles	141 0	0 578	49 34	61 0	1 788	10 96	56 3
Favors Kerosene by per cent		21 9	—0 9	—16 5	25 0	— 6 7	25 2
Kerosene—Ault. & Tay 22 E 4-cylinder 7" bore, 9" stroke 7 Deere, 14" plows, 6 miles	115 0 K 8 0 G	$0 398	54 12	80 5	1 361	10 66	73 5
Gasoline—Ault. & Tay 12 C 4-cylinder 7" bore 9" stroke 9 Deere, 14" plows, 6 miles	97 5	0 368	58 60	63 5	1 509	12 92	66 3
Favors Kerosene by per cent		— 6 8	— 7 3	—21 1	10 9	—17 5	10 9
Kerosene—Rumely 23 E 2-cylinder, 10" bore, 12" stroke 8 and 9 Rumely 14" plows, 6 miles	129 25	$0 337	51 40	72 5	1 205	11 20	77 4
Gasoline—Case 13 C 2-cylinder 10" bore, 12" stroke 10 Case-Battley 14" plows, 6 miles	155 75	0 519	55 70	83 0	2 006	9 41	44 4
Favors Kerosene by per cent		54 0	— 7 7	14 5	61 9	19 0	74 3

SOME AVERAGES

Class or Division	Kerosene	Gasoline	Favorable to Kerosene	Similar Cases in 1911
			Per cent	Per cent
Cost of Fuel an acre all competitors	47 937c	49 728c	2 7	33 8
Cost fuel-acre, 4 competitors above	44 75 c	48 32 c	8 0	21 5
Cost fuel HP-hour all competitors	1 389c	1 604c	17 7	
Cost fuel HP-hour 4 competitors above	1 368c	1 797c	31 4	37 2
HP-hours a pound of fuel all competitors	1 182	1 504	27 2	
HP-hours a pound of fuel 4 competitors above	1 349	1 584	17 4	
HP-hours a gallon of fuel, 4 competitors above	10 64	11 08	— 3 9	— 2 5
HP-hours a $1.00 worth of fuel, 4 competitors above	73 42	55 90	31 4	60 3

1911 Prices—Kerosene 12 cents a gallon of 7 9 pounds.
Gasoline 20 cents a gallon of 7 pounds.
1912 Prices—Kerosene 14 5 cents a gallon of 7 9 pounds.
Gasoline 19 5 cents a gallon of 7 pounds.
Increase in price of Kerosene, which is unfavorable, 20 per cent
Decrease in price of Gasoline, which is unfavorable to Kerosene 2 5 per cent.

The Making of a Pneumatic Automobile Tire

(Concluded from page 2.)

Spreading and Calendering.

Rubber which is used for the general line of molded goods, solid tires, some kinds of tubing, etc., goes directly to the various departments from the green-stock storeroom, while rubber used for boots and shoes, waterproof fabrics, many of the druggists' sundries, belting, pneumatic tires, inner tubes, etc., has to be sheeted out, and some of it forced into fabric before it goes to the various departments. This sheeting-out of the gum, as well as applying the rubber to fabrics, is done generally by two methods; either by spreading a solution of the rubber and spreading onto the fabric, or by calendering the rubber between heavy rolls in a rubber calender

In the spreading process, a machine called a spreader is used The fabric to which the rubber is to be applied is mounted in a roll at one end of the spreader and from the roll passes through a trough of rubber cement, and then up over a so-called doctor roll, and under a knife edge, which allows only enough cement to pass through to fill the pores of the fabric From this knife the cemented fabric passes over a steam drying chest and is then rolled up with a roll of liner cloth to prevent its sticking together Fabric thus treated must be put through the spreader a number of times before it

has accumulated rubber to be used in the products for which it is intended.

For calendering rubber, a machine called a rubber calender is used. This machine is made with three and sometimes four heavy rolls, capable of very fine adjustment. The rubber from the green-stock storeroom is first warmed up on a small mixing mill and is then fed between the rolls of the calender, coming through in a thin sheet of required thickness, and is wound up in a liner cloth and sent directly to the departments, where it is used for inner tubes, druggists' sundries, etc., where only rubber and no fabric is used. Where the rubber is to be applied to fabric, the fabric is put through the calender rolls with the rubber, and the rubber is literally ground into the fabric. Fabric thus treated is known to the trade as friction, and is generally used in the manufacture of pneumatic tires, belting, hose, etc. For boots, shoes, and other special work, calenders are used which are equipped with rolls engraved with the shapes of the soles and other parts of the articles in question, so that the sheet of rubber coming from the machine has imprinted on it the shapes and thickness of the articles for which it is intended.

After passing through such of the processes described as are required the rubber is ready to be made up into the various articles known to the rubber trade, such as boots and shoes, mackintoshes, waterproof fabrics for balloons, aeroplanes, tentings, etc., mechanical goods such as rubber heels, horseshoe pads, packing, tiling automobile and other bumpers, artificial fish bait, etc., druggists' sundries, such as nursing bottles, nipples, syringes, bulbs, hot water bottles, tubing, etc., tobacco pouches, rubber belting, golf and other balls, insulated wire, fire and garden hose, inner tubes tires and the many other commodities into the manufacture of which rubber enters. As this article has to do more especially with the manufacture of automobile pneumatic tires, we will omit the various methods used in the manufacture of the numerous articles mentioned above and pass directly to the manufacture of pneumatic motor car tires and inner tubes.

When the first pleasure automobiles were made in any quantities the tire used was of the single tube type and fastened to a crescent shaped rim by means of lugs or bolts, and cement This proved very unsatisfactory, and the clincher type tire, using an inner tube then came into prominence as an automobile tire With some variations in design, this type of tire still continues to be vary popular, but during the growth of the automobile industry, the so-called straight-sided or detachable automobile tires have been developed, and have come into favor Some of the latter type of tire are of the regulation Dunlop type, others being somewhat different Most all of these so-called straight sided tires have wires in the beads to keep them from flying off the rim. With the development of the motor truck industry, solid tires have come to be used where heavy loads have to be carried. This type of tire has been developed from the original wagon tire to the present various types of improved motor truck tires, and so-called high efficiency solid tires, of peculiar design, to give the desired resiliency and wearing qualities.

The Birth of an Automobile Tire.

From the calender room of the rubber factory, the stock is received in the automobile tire department, in the form of large rolls of rubber coated fabric, and in rolls of sheeted rubber of various thicknesses and widths. The rubber coated fabric is first cut into strips of proper widths so that the edges will extend from bead to bead over the crown of the tire. These strips are always cut on the bias, generally at a 45-degree angle, with the edge of the roll, and were formerly all cut on a cutting table, a table about 50 feet long and 6 feet wide covered with sheet metal. The cutting was done by two men, each having a knife and each cutting half way across the cloth along

the edge of a straight-edge so arranged as to be always set at 45 degrees with the edge of the table. Gradually this method of cutting is being put aside by the use of the bias cutter, an extremely up-to-date machine having jaws which ride up to the end of the fabric and pull it for a certain distance under a knife set at a 45-degree angle, the knife being set to cut just when the jaws have arrived at the limit of their motion. The action is repeated so that the machine cuts about eighty strips a minute. These strips are fed onto a series of belts which carry them to where they are placed, by boys, into a book having a leaf of cotton cloth between each strip of gum fabric, to prevent the strips from sticking together.

The majority of automobile tires to-day are built by the hand method, and in this process the books of fabric are laid up and spliced into proper lengths to go around the tire and allow a proper lapping for the splices. The proper number of these laid up pieces, or plies, as they are called, are placed together with cotton cloth between and taken to the tire builder. The tire builder mounts the core, upon which the tire is to be built, on the building stand, generally cementing it so that the first ply of fabric will stick in place. The first ply is then stretched onto the core and spliced, rolled down with a hand roller onto the sides of the core, and trimmed with a knife at the base. The following plies are put on and rolled down in the same manner, the beads being put in at the proper time, according to the size and the number of plies to be used. After all the plies have been put onto the core, the so-called cover rubber is put on. This cover rubber is generally a sheet of rubber about one sixteenth of an inch thick or more and of the same compound as the rubber on the fabric.

In the case of the machine built tire, the result is the same, but the stock is handled as follows. After the rubber coated fabric has been cut on the bias cutter, the strips are spliced and rolled up in rolls on a spindle which is placed in the so-called tire building machine. The tire core is mounted on a stand attached to the machine so that it can be revolved by power and the fabric is drawn onto the core from the spindle under a certain definite tension. The tire machines roll the fabric down by power, and the beads are put into place before the tire and core are removed from the machine. Thereafter the process is the same as in the case of the hand-built tires.

After the cover rubber is in place the tire is ready to have the tread applied. The tread is made up independently of the tire by laying up narrow strips of rubber, in different widths, in such a way that the center of the tread is thicker than the edges. In the case of the so-called single cure tires, which are wholly vulcanized at one time, this tread is applied to the tire directly after the cover, a strip of fabric called the breaker-strip, generally being placed underneath, and the building of the tire so completed.

How the Tire is Cured.

In the general method of curing, the tire is allowed to remain on the core, and is either bolted up in a mold and put into an ordinary heater or it is laid in a mold and put into a heater press where the hydraulic pressure keeps the two halves of the mold forced together during the vulcanizing process. After the vulcanizing is completed, the tire is removed from the mold, the inside is painted with a French talc mixture, the tire inspected and cleaned, and so made ready for the market. In some methods of curing, the tire is put into a so-called toe-mold, which is virtually a pair of side flanges, reaching up only as high as the edges of the tread on the sides of the tire. After the flanges are fastened into place, the whole is cross-wrapped, the cross-wrapping coming in direct contact with the tread. The tire in this condition is then put into the heater and vulcanized, giving the so-called wrapped tread tire. Still another form of curing is to inflate a kind of canvas inner tube inside the tire and place the whole in a mold. This is known as the air-bag mold process.

From the case of the single curved tire just described, we will take up the case of the so-called double cure tire, in which the tire receives two separate vulcanizations. In this system of tire manufacture, the tire carcass is semi vulcanized before the tread is applied. This first vulcanization is always done with the tire on the core, and either bolted up in a mold or cured in a mold in a heater press, the period of vulcanization being only long enough to partially cure the rubber. The tire carcass is then taken from the mold and mounted on a buffing machine, and that part of the cover which is to be covered by the tread is buffed to a rough surface, which is then given one or more coats of rubber cement, allowed to dry, and the tread, which is generally made of some quick curing compound, is then applied in the green state. The tire is cross-wrapped, either by hand or by a cross-wrapping machine, placed in a regular heater and given the second cure. This second cure is timed to complete the cure of the carcass and also to completely cure the tread. After removal from the heater, the cross wrapping is stripped from the tire, the tire inspected, the inside painted, and so made ready for the trade.

Authorities differ as to whether the integral construction or single cure method or the semi-cure method produce the better results. Advocates of both systems are able to advance strong arguments in support of their respective methods.

The Three Kinds of Inner Tubes.

Inner tubes for pneumatic tires may be classed under three headings, according to the method used in their manufacture, viz., seamed tubes, rolled tubes, and tube-machine tubes. By far the greater number of tubes come under the first two headings. For seamed tubes, the rubber is taken from the calender in the form of sheets from 1/16 to 3/16 of an inch in thickness. These sheets are cut into strips of proper length and just wide enough to make a tube of proper cross-section diameter when the two long edges are folded over and fastened together with rubber cement. These two long edges are cut on a bevel so that they make a good lap seam. The tube is then pulled over a mandrel of proper size and a thin piece of wet cloth rolled around it and then it is spirally cross-wrapped with a long narrow piece of wet duck, for its entire length. The whole is then put into a regular heater and the tube vulcanized. After vulcanizing the wrapping is removed and the tube stripped from the mandrel, turning the tube inside out, so that the smooth side which was vulcanized next to the mandrel appears outside and the rough side showing the marks of the cross-wrapping, is inside. The valve hole is then punched in the tube, the valve inserted and the open ends of the tube buffed down to a feather edge. The tube in this state passes to the splicers, who cement the buffed ends and splice them together, placing one open end within the other making a lapped seam around the tube about 2½ inches long. The cement used in splicing is generally cured by an acid which chemically vulcanizes the rubber without the application of heat. The tube is thus finished and ready for the market. Rolled tubes are made from very thin sheet rubber by rolling the same over a mandrel of proper size, until the required number of layers of thin rubber have been rolled on to give the tube the desired thickness. The tube is then wrapped, cured, and spliced, in exactly the same manner as a seamed tube. Tube-machine tubes are run from a tube machine exactly like wagon tires, except that a die is used which permits the rubber to flow out in tube form. This tube is then pulled onto a mandrel, wrapped, cured and spliced, the same as the seamed and rolled tubes.

Europe's Good Roads

(Concluded from page 51.)

international thoroughfares in that they take note of the incomings and outgoings of all wheeled traffic, including automo-

biles, and are charged with the responsibility of seeing that driving licenses and registration and tax dues have been paid in the country of origin. The International Driving License, which has been put into use during the past couple of years, in no way precludes the obligation to conform to the demands of the customs officials and, in short, in one way or another this service works in conjunction with the roads control branches of the respective governments. On certain of the Swiss passes, all of them in fact that are open to automobile traffic, notably the Simplon and the Saint Gothard, a running time card, as it might be called, is issued by these same authorities limiting the passage over the mountain road to a certain pre-arranged time schedule, this in an attempt to regulate the speed on these dangerous mountain roads and as such it certainly does work effectively, as one is not let out at the other end if he arrives before the hour indicated on the permit.

Taxation of rubber tired traffic abroad is generally far in excess of what it is in America, but in France it does not go specifically toward road building or even amelioration, but is paid into the general coffers of the national treasury Including bicycles (of which there are three million circulating in France) there is contributed a sum equal to nearly three million dollars per year When the day comes—and there are signs visible which point that way—that this sum entire, save the costs of collection, is devoted to the building of automobile boulevards, call them by what name you will, at any rate thoroughfares intended only for fast traffic, France may be expected to double her lead over all countries of Europe as the automobilist's paradise. In this connection it is worthy of regard that automobile registration in France is considerably less than a hundred thousand vehicles, the largest French manufacturer producing only something like seven thousand chassis in a twelvemonth The result is that there are six miles of the finest road way on earth for each automobile that rolls over them. Some American manufacturer with a desire to pose as the real populariser of the automobile, *à la portée de tout le monde*, as the French say, has only to follow in the footsteps of the exploiters of the kodak to find himself in touch with a world market which has as yet only been scraped over

Partnership Use of a Motor Car

By P. H McKilwin

SINCE there are a great many persons who have been deterred from buying and using automobiles by the cost of running and maintaining them, the suggestion that two or more men go into partnership in the ownership of a car and divide both the cost of the machine and the expense of using it offers a possible solution of the problem that confronts thousands who greatly desire to enjoy the pleasures of motoring but have not felt in position to do so

The idea is new but there are a number of cases of the kind, one on Long Island in which seven friendly neighbors in a suburban place bought a car which is kept in a public garage and used to take them from their homes to the railroad station in the mornings and to meet them at the station in the evening, in addition to this, each part owner is entitled to the use of the car one day each week

No doubt there are thousands of families that would gladly pay half or a third or quarter of the cost of buying and keeping an automobile, yet who would put off indefinitely the buying of a car for their own individual use

There are two fundamental plans on which copartnership ownership and use can be carried out The simplest is an even division of all expenses, irrespective of the personal equation, which has the advantage of rendering bookkeeping or account-keeping unnecessary and avoids disputes over liability for damage done by careless driving, inexperienced handling and various small abuses Under such an arrangement one owner may get more mileage out of the car and tires, carry more passengers and generally get a larger return for his money than his partner If the partners are particularly good friends or relatives and are indifferent to small differences of this kind, the matter of dual ownership is extremely simple But if, on the contrary, it is desired that neither shall pay less nor more than his use of the machine makes equitable, it becomes necessary to divide the expenses into fixed and variable charges The fixed charges include the cost of the car and of any equipment subsequently purchased, storage, insurance, and overhauling and repainting when these are agreed upon The variable charges are those due to actual use of the machine, such as gasoline, oil and other supplies, tire wear, cleaning and so forth

It is evident that the fixed charges should be divided equally, but the variable charges should be paid by the partners according to their actual use of the car and liability for them Thus, if the car is kept in a private garage, the bills for simple storage could be rendered monthly and paid equally by the owners or alternately as agreed upon, but the bills for washing, adjusting, polishing, gasoline, and oil should be rendered weekly so that each of the owners can pay the bill for the week during which he actually used the car This is on the assumption that the car is used alternate weeks by the copartners, which is likely to prove the most satisfactory arrangement.

In order to avoid misunderstanding, it is almost imperative that a carefully thought-out agreement be drawn up in duplicate and signed This would state definitely the weeks on which each owner would have the use of the car This gives each the advantage of an equal number of Saturdays and Sundays They can trade off their time when one or the other is to be away on business or vacation Should any differences arise over this or other matters, the obvious way out without causing ill feeling, is for one to offer to sell his interest or to buy his partner's.

A full line of insurance covering losses by fire, theft, accident or collision should be carried and the payment of the premium divided equally The policy should cover small losses as well as the major ones, which is possible under the "full coverage" clause provided by the insurance companies.

Tires, like gasoline, are consumed and the consumption bears a close relation to mileage and to the way in which the driver uses the car Therefore, it would probably be wise for each partner to keep a record of his mileage and pay his part of the tire bill on this basis. Repairs of punctures and blowouts would be chargeable to the one using the car at the time they occurred, except in cases where they resulted directly from cuts or other injuries known to have occurred while his partner was using the machine Damages impossible to trace clearly should be divided equally

Miscellaneous small repairs and replacements, which are not covered by the manufacturer's guarantee, would most equitably be charged against the one using the car at the time the fault developed Of course, a break might occur during B's use of the car as a result of some unusual strain occasioned while A had the machine out, but this is an eventuality as likely to occur one way as the other

A successful carrying out of the plan herein outlined is dependent upon the common sense and spirit of fairness that animate the parties to the arrangement. Each should constantly remember that he is entitled to only half the use of the machine and that his partner, by putting up with the same limited use and dual responsibility, is really making it possible for him to enjoy the use of a car at all

What the annual costs to each are likely to be may be estimated approximately from the following table of itemized cost of maintaining two different types of family touring car, one a four-passenger light car costing $1,150 and the other a five-passenger car of about double the weight and power costing $2,200

	$1180 Car Drives 8,806 Miles in Eleven Months.	$2200 Car Drives 9,400 Miles in Ten Months.
Gasoline	$87 68	$149 28
Oiling and greasing	26 49	48.87
Battery charging and lamp renewals	10 13	10.85
Storage	53.85	102.30
Washing and polishing	80.25	96.25
Tires, tire repair and depreciation	79.37	370 03
Miscellaneous repairs.	46.94	65 00
Sundries	26.85	55 71
Spark plugs and coils	26.95	2 00
Insurance and licenses	42 00	102 91
Drivers, fines, help and fees	18.50	57 10
	$499 01	$1 060.30
Interest at 6 per cent	69 00	132 00
Depreciation	550 00	800 00
	$1,118 01	$1 992 30

Special Resources of American Libraries

EVERY scholar will welcome with enthusiasm the latest publication of the United States Bureau of Education 'Special Collections in Libraries in the United States,' compiled by W Dawson Johnston, librarian of Columbia University and Isadore G Mudge reference librarian of the same institution

Inaccessible books are the bane of every seeker after knowledge The special bibliography only half solves the problem The time will come when no special bibliography will be considered wholly meritorious unless it contains in connection with the title of every rare book a list of the libraries in which the book is to be found, or if this imposes too much labor upon the bibliographer unless at least *one* copy of the book is thus located. With this improvement coupled with the modern system of interlibrary loans the bibliographic millenium will be pretty nearly attained

Pending such a consummation a hand book similar to that just published by the Bureau of Education is an admirable makeshift Here we find a list of libraries in which each department of knowledge is most fully represented, with sundry particulars as to the strength of each collection along a particular line

To illustrate with a few out of the-way topics If you are looking for the literature of philately, you find, by way of the index, that the Pittsburgh Carnegie Library has a philatelic collection of 342 books, pamphlets and periodicals donated in trust by the American Philatelic Society, while the Boston Public Library possesses 210 works on the same subject If you wish to investigate chess try the Library Company of Philadelphia This institution is the depository of Prof George Allen's chess library, containing 1 070 volumes, besides newspaper clippings, manuscripts, and pictures relating to the game. The literature of the whaling industry is represented by 750 volumes in the New Bedford, Mass., Free Public Library The Berkshire Athenæum, at Pittsfield, Mass., has a collection of addresses at agricultural fairs. Cornell University Library has a Petrarch collection of 3,700 volumes, and a Dante collection of 7,000 volumes (exceeded in importance, if at all, only by the collection in the Biblioteca Nazionale, in Florence) Williams College Library has 162 volumes relating to Phædrus. Harvard University has a collection of Yiddish literature numbering 4,800 volumes and 1,600 pamphlets. The Masonic Library of Cedar Rapids, Iowa, has the most important collection in the United States on freemasonry and related topics, which in 1898 numbered about 15,000 volumes, of which 5,000 were in foreign languages. The Library of the Supreme Council of the Ancient and Accepted Scottish Rite of Freemasonry, in Washington, has a collection of about 1,000 volumes on occult and allied subjects. And so on.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

BEET TOPPER AND DIGGER.—J DEVEY, Lehi, Utah The object of the invention is to provide a simple and easily operated device for topping and digging, especially adapted for use in harvesting sugar beets, which will first top the beets while yet firmly held in the soil and will afterward dig them The present invention is an improvement over the prior patent, No 975,218, granted to Mr Devey

BEET DIGGER, CLEANER, AND ELEVATOR.—J DEVEY Lehi Utah The object here is to provide a device for use in connection with an improved topper and digger shown and described in a copending application Serial No 612,179 for lifting, cleaning and loading the beets topped and dug or loosened from the soil by the said improvement

KAFIR CORN HARVESTER.—S B PETER, 705 West 3rd St Pittsburg Kan In the present patent the invention is an improvement in Kafir corn harvesters, and has for its object the provision of a simple inexpensive device for use in attachment to an ordinary farm wagon for cutting the stalks of the corn to remove the valuable portion

FENDER ATTACHMENT FOR MOWING MACHINES.—S M MARTIN Heatherdale, Prince Edward Island Canada This attachment can be readily attached to a mowing machine An object of the inventor is the provision of a device which will be simple in construction, which can be swung out of the way when it is not desired to use the same and which is provided with an adjustable stop and shock absorbing mechanism

Of General Interest.

DISPLAY RACK.—CATHERINE HOLLAND, 88 Zeidler Ave Maspeth L I N Y This invention has particular reference to rack devices adapted especially for domestic use or in connection with private laundries, the primary object being to provide a rack embodying cheapness of construction, facility to knock down and set up, lightness for transportation purposes, and stability of position while being used.

PROCESS OF MANUFACTURING BEET SUGAR. V KOLARAK Owosso Mich An object of this invention is first to produce from decayed beets a juice with the highest purity possible when the purity of the beets is below 80 per cent A further object is to obtain a better lime cake than by the ordinary method

COMPOSITE BUILDING BEAM W P FRANCIS, 115 Marietta St Atlanta Ga The invention provides an economical and simplified construction provides anchoring devices for uniting the masonry and the metal structure the arrangement of which distributes uniformly the breaking of the strain over the entire structure

WINDOW.—R. B HARTSFIELD 210 W 114th St Manhattan New York N Y The invention relates to windows having stiles mounted to slide up and down, and sashes pivoted on the stiles to admit of turning the sashes on the stiles The aim of the invention is to provide a window arranged to permit of conveniently turning the sashes with a view to allow cleaning of the outer faces of the sashes from the inside of the room.

Hardware and Tools.

LATCH.—W LARSEN Westbrook Minn. The invention pertains to latches particularly adapted for use in connection with doors, gates and the like and the aim is to provide a device of this character which may be adapted with equal facility upon gates and doors which swing either toward the right or the left hand.

KEY LOCK.—L. B. HOWARD, P O Box 394, Los Angeles, Cal This device may be used to fasten door keys in place to absolutely prevent a burglar from removing or turning the key from the outside making it impossible to lock the door from the outside It will also prevent children from removing the key from the lock which is a source of great annoyance and causes the loss of many keys.

HOSE REEL.—C WAGNER, 587 Hudson St., New York, N Y This hose reel is more especially designed for use on stand pipes in buildings to permit of quickly unreeling the hose with the water turned on and allowing an almost instantaneous passage of the water through the hose as soon as a fire breaks out and water is turned on from the stand-pipe.

METAL WORKING SHEARS.—C. H. PRINCE, 123 East Ave., L. I City New York N Y The invention provides a pair of shears of compound leverage, the construction and arrangement being such that the handle levers of the shears are prevented from working loose, being pivotally mounted in housing carried by the blade ends.

Heating and Lighting.

BUILDING LIGHT.—J STANLEY, 446 Mott Ave Bronx, New York, N Y The intention here is to provide a building light for use on sidewalks, vault covers, area lights, sky lights and the like, and arranged to compensate for expansion and contraction, with a view to prevent breaking or cracking of the lenses.

IGNITER.—F THOMAS, 478 Pine St., San Francisco, Cal. This invention consists essentially of an igniting device and an actuating means for normally holding the device in a dormant position, the actuating means being sensitive to atmospheric conditions and being actuated on a fall in temperature of the surrounding atmosphere to ignite the device and to thus set an inflammable material on fire.

COOKING UTENSIL.—F D CALKINS, 89 Charlotte St., Detroit, Mich This utensil is in the nature of a foraminous vessel designed for use in steaming, boiling, etc, within an outer vessel The invention relates particularly to means for reinforcing the foraminated body by means which are extended at one end to serve as legs for supporting the vessel and at their other ends as fastening means for holding the lid in place

STOVE POLISHING MITTEN.—NELLIE M SPRINGHORN, Blue Point, L. I., N Y The object of the invention is to provide an improved stove polishing rubber mitten designed to enable the user to keep a blackened stove to fine polish without requiring re-blacking for a considerable time and to readily remove water grease spots, and other extraneous matter thus keeping the stove clean and nice for a very long time and without danger of rusting.

COMBINED KITCHEN CABINET AND CUPBOARD.—C F WELGE care of Welge Bros., Chester Ill. The permanent features of the cupboard are so arranged as to permit of the lower portion of the cupboard receiving and supporting a hinged lid provided on the cabinet. The lid forms the cover for a flour bin and for a kneading board which is solidly supported below the lid and conveniently located with respect to the bin

BED-FAN.—R. N CHRISTIAN 4457 Oakenwald Ave Chicago Ill This invention relates to improvements in automatic fans and air circulators, and has for its object to provide means whereby the air above a bed may be cooled and caused to circulate It consists principally of a series of flat horizontally disposed and spaced strips of flexible material arranged above a bed, said strips to have vertical movement at one end It can be used in offices, workshops, out door camps, and can be readily folded and packed away

Household Utilities.

SASH FASTENER.—O M FARNHAM Lincoln Maine The present invention has reference to sash fasteners, and is more particularly applicable to the character of sashes which are temporarily installed such as storm windows, or window screens for porches or structures of a similar character

Machines and Mechanical Devices.

MEANS FOR LAUNCHING TORPEDOES FROM THE SIDES OF SHIPS.—ALBERT E JONAS Fiume Austria Hungary This invention provides means for launching torpedoes from the sides of a submarine vessel a torpedo boat or other light vessel at any angle and by means of a torpedo launching frame jointed to the sides of the ship. The purpose is to insure that the torpedo shall exactly follow the direction imparted by the torpedo launching frame at the moment at which the latter is locked and to prevent any deviation due to the gyroscope becoming operative prematurely

PAPER POLISHING MACHINE.—H OSBORNE, 992 4th Ave., Brooklyn N Y This improvement relates generally to paper polishing machines and more particularly it is directed to a structure comprising coöperative parts whereby the pressure of the movable stone may be adjusted so that the operation of the parts may be rendered more efficient

AUTOMATIC FILTER PRESS.—R. LAMMON and R P HOLMES, Boulder City Western Australia Australia This machine is for use in separating the liquid from the solid portion of liquid pulp by means of pressure and compressed air and is particularly applicable to the treatment of ores in a fine state of division commonly known as slimes, in which the gold or silver is dissolved and taken into solution by means of chemical solvents

TUMBLER FINISHING MACHINE.—J J DENNING Gas City, Ind. This invention provides a structure whereby a tumbler or the like may be quickly polished or finished. Means provide for holding and rotating a tumbler associated with a universally pivoted buffing member designed to be braced against a tumbler while rotating for polishing the same

STARCHING MACHINE.—W B. BURT, care of Bloesser Heynemann Co., 77 Battery St., San Francisco, Cal The invention provides improvements in starching machines such as are used for starching collars, cuffs and other articles, and whereby a constant supply of starch is furnished to the working portion of the upper cylinder to allow starching at a single operation even if the article is of a length in excess of the circumference of the cylinder, thus greatly increasing the machine's output.

CAN HEAD LINING AND ROLLING MACHINE.—H L. GUENTHER, 273 N Ave. 22, Los Angeles, Cal. This machine is for use in placing liquid cement or other packing material onto the flanges of can heads, and to bend over the flange edges, to confine and hold

the packing material in place and to prevent the can heads from sticking one on the other when stacked for shipping or storage the said material after drying forming a lining or packing and when the can head is finally attached to the can body and the flange is crimped and compressed onto the can body then a can is produced having an air-tight double seam

Railways and Their Accessories.

BRAKE SHOE.—J M. WOODWICK 102 Church St Montgomery Ala. This improvement is in car wheel brake shoes and dressers, especially in that class of such devices wherein an insert of comparatively hard metal is combined with a body portion of softer metal and affords a wearing surface to operate upon the car wheel. The invention relates to certain improvements in the insert construction

Pertaining to Recreation

GAME APPARATUS—H G ROBINSON L. B. 1733 Salt Lake City Utah This game is similar to golf Marbles are used in place of golf balls, and a knocker instead of golf sticks is used this knocker of thin steel and having at one end a grip by which the said end of the knocker may be drawn back so that when it is freed it will hit the marble with sufficient force to propel it in the direction of the pocket which is pivoted so that it may be moved as desired

Pertaining to Vehicles.

SPRING WHEEL. E L. COLTRY R. F D Red Oak Iowa This improvement is in wheels which are provided with an elastic tire or tread formed of spring metal parts or members and intended as a substitute for the expensive pneumatic or solid rubber tires usually employed on the wheels of automobiles and other motor driven vehicles

SIGNALING DEVICE —CHARLES A SCHINDLER 287 Palisade Ave West Hoboken N J The invention relates to signaling devices such as shown and described in the Letters Patent of the U S. No 1,015,715 formerly granted to Mr Schindler The object of the present invention is to provide a device more especially designed for the use of chauffeurs and other drivers of vehicles and arranged to enable the user to readily give an audible signal during the day and a visible signal at night to a following vehicle whenever it is desired to turn out of the direction in which the vehicle is travelling or for other purposes. Use is made of a glove provided on one finger with spaced contacts either of which is adapted to be engaged by a circuit closing contact on an opposite finger the said contacts being in two electric circuits connected with a single source of electrical energy one circuit containing an electric lamp and the other an audible alarm

CART —F F WALTHER R F D Scribner Neb The object of the invention is to provide a simple cheaply constructed cart light in weight yet strong and nicely balanced and consequently of light draft With this improvement the horse can travel in a smooth path and the wheels will also travel in the beaten portion of the road By moving the seat to the proper position the body can be so balanced that the weight is taken off the horse's back

GEARING J F COLLINS 253 West 111st St Manhattan N Y., N Y This invention refers especially to gear casings adapted especially for automobile practice The casing secures greater facility in inspecting and making repairs in that type of automobile transmission mechanism in which are used both the slidable gear speed changing devices and the worm driven mechanism than has hitherto been possible

RESILIENT WHEEL T E VAN DER WERKEN care of C C Finch Surrogate's Office Green Island N Y The purpose here is to produce a vehicle wheel to resiliently support the load strains of a moving vehicle such as an automobile and to take up and cushion the shocks incident to the moving of the vehicle over uneven roads without the use of pneumatic tires.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each Please state the name of the patentee, title of the invention and date of this paper

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade mark work Our staff is composed of mechanical electrical and chemical experts thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized technical, or scientific knowledge required therefor

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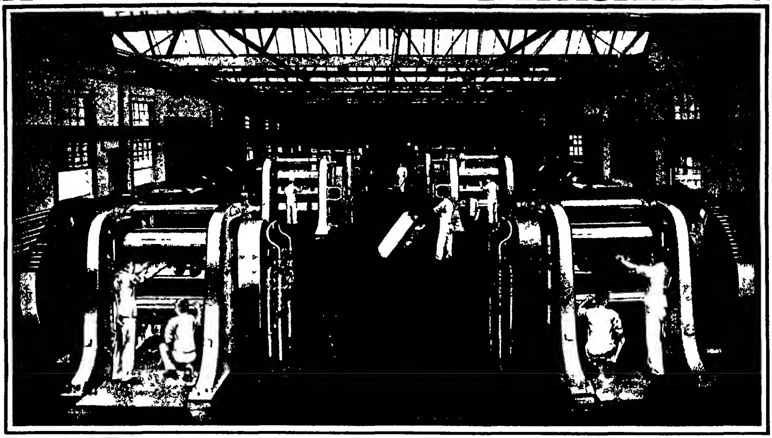
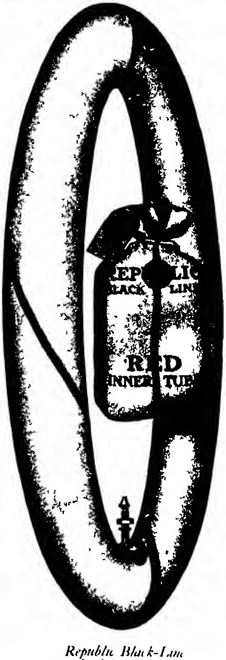


This is The Republic Rubber Company New Calender Room



Republic Black-Line Red Inner Tube

Where machines and brains make tire mileage for YOU

Republic Staggard Tread Tires give you the mileage you really ought to get because their foundation is *right*.

The foundation of a tire consists of alternate layers of fabric and rubber And the efficiency of any tire depends to a great extent upon the manner in which the fabric and rubber are treated and combined

The illustration above shows the Republic Calender Room—the new "rolling mill" of this rubber plant where foundations for Republic tires are made

In this great room man's skill and ingenuity and modern machinery combine to make the *right* foundation for Republic Tires Scientific, pains-taking care is exercised in every operation from testing and drying the fabric to calendering ("rolling") the rubber and combining the two under proper heat and pressure

And on this *right* foundation is put the Staggard Tread—the tread of extra thickness that leaves the full-thickness plain tread after the center studs eventually wear off

The Staggard Tread is protection against skidding, and really economical because of the extra mileage it gives you

Write today for beautiful folder on this wonderful new Calender Room

THE REPUBLIC RUBBER COMPANY
YOUNGSTOWN, O
Branches and Agencies in the Principal Cities

REPUBLIC STAGGARD TREAD TIRES

Republic Staggard Tread Pat Sept 15-22, 1908

The Original Effective Non-Skid Tire

What Shows Don't Show

By R. E. Olds, Designer

You'll see the new model of Reo the Fifth at your local Automobile Show.

It will strike you as beautiful, luxurious, roomy—having every final touch.

But here are things you can't see. And they mean, in the end, more than all that shows.

Tire Mileage

Tires on a car form the chief item in upkeep. Tire-saving means more than all other savings together. Every old motorist knows this.

So this year I add 30 per cent to my tire cost, to add 65 per cent to the average tire mileage. I give you tires 34 x 4. Compare them with rival cars.

The usual tires on this type of car would more than double your tire cost, so tire makers say.

No Possible Flaws

The steel in this car is twice analyzed, to make sure it accords with my costly requirements.

The gears are tested in a crushing machine, to prove that each tooth will stand 75,000 pounds. This test is usually made with light hammers.

The springs are tested in another machine to stand 100,000 vibrations.

I use in this car 190 drop forgings. The average cost is twice that of steel castings.

But they give me lightness and strength. And hidden flaws can't occur in drop forgings.

The various parts of this car get a thousand inspections. Thus all the uncertainties are completely eradicated in building this Reo the Fifth.

No Broken Bearings

I use in this car 15 roller bearings. 11 of them Timken, 4 Hyatt High Duty.

They cost five times as much as the usual ball bearings. But good roller bearings don't break under strain.

No Overtax

It's the sudden shock which shows up a car's weakness, not the ordinary tests. And sudden shocks will come.

To withstand them I give to axles and driving parts 50 per cent over capacity. I have made them all ample for a 45 horsepower car.

To prove them out I run one of these cars for 10,000 miles, at top speed on rough roads. I met at its worst every possible road shock and not one important part gave out.

I use 14-inch brake drums. I use 2-inch, 7-leaf springs. I use costly steels—chrome nickel, vanadium, manganese—all to ward off an overtax. I place cost below safety in this Reo the Fifth.

No Troubles

That isn't quite true. All machines have their little troubles. But I've gone to the limit to save trouble with this car.

Each engine is tested 20 hours on the blocks, and 28 hours in the chassis. There are five long-continued tests.

My carburetor is doubly heated—with hot air and hot water—to save the troubles with low grade gasoline.

I use a $75 magneto to save ignition troubles. I use a centrifugal pump, instead of a syphon, to insure the water circulation. That costs about $10 extra.

Cars are built slowly and carefully, parts ground over and over. I limit my output to 50 cars daily, so nothing shall be slighted.

No Skimping

To make the car show my infinite pains, I give equal care to the finish.

The body has 17 coats. The luxurious upholstering is of genuine leather, filled with the best curled hair.

There are three electric lights, and the dashboard lights are flush. And the whole car, even under the hood, is fully nickel trimmed.

Center Control

Our center control is exclusive to this car. All the gear shifting is done by one small handle, completely out of the way. It is done by moving this handle only three inches in each of four directions.

Both brakes are operated by foot pedals. So no levers at all clog the way of the driver. And this permits of the left side drive.

No other center control will please a man who once discovers this.

Add $200 to My Cost

These extremes I figure add $200 to the necessary cost of this car.

They cut down our profits. They force us to factory efficiency. They compel us to build every part ourselves. And to minimize cost we build only one chassis.

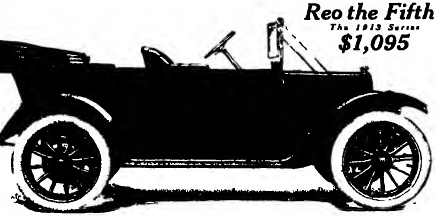
But these things save users from three to ten times what it costs me to give them to you.

They insure to you safety, economy, comfort. They insure to me that reputation I have spent 26 years in acquiring.

I find that car users, more and more, are coming to look for this class of car. Our output is always much oversold. And this year, with 60,000 excellent cars to my credit, the demand will be greater than ever.

A thousand dealers are now ready to show this new model of Reo the Fifth. Our 1913 catalog is also ready. Write us for it now.

Reo the Fifth
The 1913 Series
$1,095



30-35 Horsepower
Wheel Base—112 Inches
Tires 34 x 4 Inches
Center Control
Roller Bearings
Demountable Rims
3 Electric Lights
Speed 45 Miles per hour
Made with 2 and 5 Passenger Bodies

Top and windshield not included in price. We equip this car with mohair top, side curtains and slip cover, windshield, gas tank for headlights, speedometer, self-starter, extra rim and brackets—all for $100 extra (list price $170).

R. M. Owen & Co. General Sales Agents for **Reo Motor Car Co., Lansing, Mich.**

Canadian Factory, St. Catharines, Ont.

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SCIENTIFIC AMERICAN

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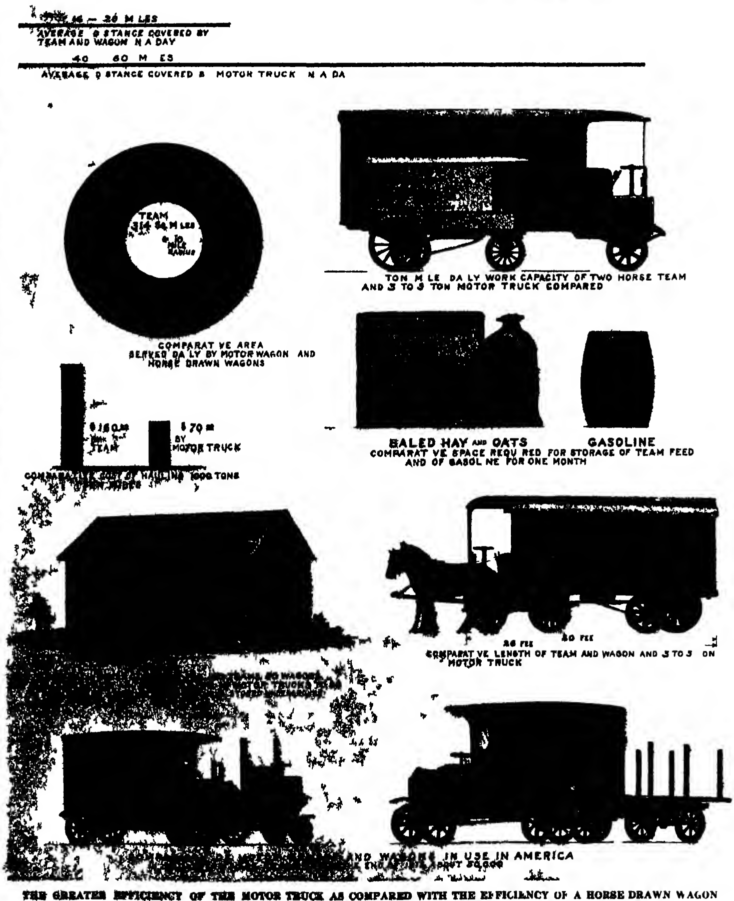

THE GREATER EFFICIENCY OF THE MOTOR TRUCK AS COMPARED WITH THE EFFICIENCY OF A HORSE DRAWN WAGON

[See page 66.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement.

Comparing the Incomparable

IN the earlier years of the motor truck the relative efficiency of electric and gasoline driven vehicles formed a common topic of discussion. To-day, such partisanship has practically ceased, for it is generally realized that each type has its own distinct sphere of service, and it is useless to pit one against the other when they do not run parallel courses. Generally speaking, the electric truck excels in territories of small radius, while the gasoline truck is pre-eminently adapted for long hauls. There are exceptions to this classification, of course; under certain conditions the gasoline truck can be used to advantage in a small territory, and occasionally very long hauls are made with electric trucks. But as a rule, large users of motor vehicles find it necessary and economical to use both the gasoline and the electric types.

In the present issue of the SCIENTIFIC AMERICAN two motor truck comparisons are published, based on data from different sources, and they appear to be rather discrepant. One confines itself to comparing the motor truck with the horse, while the other goes a step further and compares the gasoline with the electric wagon. At once the question arises, where are the points of contact? The comparison is based on an exceedingly large number of observations made by the Massachusetts Institute of Technology. These observations have been carefully tabulated, and it was found that the only unit common to all is the cost per mile of operation. The estimate of expenses has been very thoroughly summed up. It is distributed under four main heads, namely, the energy source, maintenance, garage or stable, and overhead charges. The investigators realized the difficulty of making their estimate. It was hard to judge the depreciation of a machine in the limited time during which the observations were taken. This could not be based on the work of old machines. The motor truck is still undergoing development and is constantly being improved, and no doubt new machines, although they have not yet shown their work, are longer lived than the older ones. Despite these difficulties the Institute has made a comparison which we have translated into a picture on page 70. The result is startling indeed. It is remarkable that the horse is not so hopelessly outclassed, particularly for light delivery, as we had been led to believe by previous comparisons. For half-ton parcel delivery wagons, the horse-drawn vehicle costs only two cents per mile more than the electric, and it is actually two cents per mile cheaper than the gasoline vehicle. Even with the two-ton vehicle he holds his own, and it is not until it has passed the 5,000-pound mark that the gasoline curve intersects the horse curve. As we proceed toward heavier vehicles, it will be seen that the gasoline truck is gradually creeping up on the electric truck and leaving the horse-drawn truck far behind. In fact, it looks as if the gasoline curve would cross the electric curve somewhere between the six and seven-ton mark.

One important factor we have so far overlooked, namely, the extent of territory covered by the various types of trucks. This is a most important consideration. The Institute tells us that the territory covered in each case is assumed to be within four miles of the loading point. That at once explains the poor showing of the gasoline truck. The gasoline truck has been taken out of its element to compare it with the other two types. Is it not like comparing a Marathon runner with sprinters over a one hundred yard dash?

In Defense of Brain Property

IN the hearings before the Committee on Patents, held to receive the views of inventors and manufacturers on the Oldfield Bill, which seeks among other things to compel a patentee to grant licenses under certain conditions, the fact that the American patent system, since its foundation, has given to the public—as distinguished from the patent owner—greater advantages in profiting from inventions than the public has ever had or ever seriously demanded has been completely overlooked. That the benighted constitution makers one hundred and twenty-five years ago could actually have tucked into that reactionary document a piece of the most up-to-date "public ownership" idea, by fixing a "limited period" for the private ownership of an invention, is a notion still so novel that it is hardly to be wondered at that statesmen who have ceased to read the Constitution should entirely miss it. Labor agitators are loudly demanding that the laborer shall own the thing that he produces. That is exactly what the Constitution granted to the inventor, for the inventor is actually allowed to own for limited periods the thing that he created. Why then reduce to nothing the single successful socialistic property institution in our Government?

The full significance of the reactionary measure that Mr. Oldfield would like to see enacted into law, can be appreciated if we translate the terms of his bill into another language, as it were. If Congress should solemnly determine that if anyone permits his real estate to go unimproved, his houses to remain unoccupied, his horses to stand idle, or his clothing to hang unworn for more than three or four years, then anyone else in the United States may hail him into Federal Court, and by legal proceedings extort the unconditional permission to build on that real estate, to occupy the houses, to use the horses, or to wear the clothing, simply upon paying to the unfortunate owner a sum which the court, after some guessing, deems just," we would have almost an exact parallel to the doctrine that Mr. Oldfield seeks to engraft upon our patent system.

The purpose of the patent laws of the United States seems to have been ignored. What does the public demand? Simply disclosure of the invention and the right to enjoy it unrestrictedly after the lapse of a certain period. If the limited monopoly that the inventor now receives is curtailed in the manner proposed, we may expect to find manufacturers refusing to take out patents and endeavoring to keep their processes secret.

Indeed, even the present patent system is not quite liberal enough for some inventors. Dr. Baekeland testified before the committee that a well known photographic paper that he once manufactured is still made by a secret process, and Mr. H. Ward Leonard, a distinguished electrical engineer and inventor, stated that certain enamelling processes of his were not patented, but were carried out in secret. The inventions of both men are valuable, yet it is doubtful if the public will ever enjoy them in the manner contemplated by the present patent laws. Sir Henry Bessemer, in his fascinating autobiography, tells us that he invented a process for making bronze and gold powders, which process he kept secret, we believe, for a number of years. Out of that secret process he made the fortune which afterward enabled him to engage in the costly experiments that eventually gave the world Bessemer steel. If the English patent laws had been somewhat more liberally framed, Bessemer would not have been allowed to enjoy a monopoly which unquestionably deprived the public of a great right.

The Block Signal and Control Board

IN view of the present widespread public interest in the subject of safe railroad travel, we direct attention to the fourth annual report of the Block Signal and Train Control Board, a document which should be in the hands of every one who is giving or about to give practical attention to this matter. Copies can be obtained either gratuitously or at a very small price on application to the Superintendent of Public Documents at Washington. The report not only gives a *résumé* of what has been done in the way of either encouraging or compelling the railroads to install safety appliances, but (and this is perhaps even more important and illuminating) it outlines the proper attitude of the Government to the railroads in the matter of compulsory legislation, and sounds a timely note of warning as to the inadvisability of hasty legislation, that is to say, of legislation which runs ahead of the actual state of the art, particularly as regards the question of automatic train stops.

Let it not be supposed from what we have said above that the claim of the railroad officials made at the recent investigation of the Westport disaster in this city that there was no practicable train stop in existence, is warranted by the facts. For several years past the Board has been carrying on exhaustive tests on automatic stops which in its judgment gave promise of being of practical value. Speaking of these tests, the report says: "The information obtained from tests, together with knowledge of the general state of development of the art of automatic train control, leads the Board to conclude that there are several types of apparatus and methods of application which, if put into use by the railroads, would quickly develop to a degree of efficiency adequate to meet all reasonable demands." Yet the Board is perfectly fair to the railroads, for it says that it does not wish to be understood that the conditions of entirely acceptable automatic train control as formulated by it in the ten characteristics published in its report (see page 67 of this issue) are fully met by any one of the devices it has thus far examined. In the opinion of the Board the art of automatic train control is "still largely in the experimental stage," but it considers that it is far enough advanced to warrant the installation of available devices with a view to their further development to meet the demand for safety in train operation.

It is well understood by those of us who keep in touch with railroad matters that, hitherto, the railroads have not only failed to show any disposition to encourage the invention and development of the automatic stop, but that they have been, in most cases, strongly averse to it. This opposition certainly cannot be due to a belief that the production of a satisfactory device of this character is mechanically impossible; for the mechanical or electrical elements involved are not materially different from those used by the railroads in the every-day operation of their interlocking and block signals, train brakes, and other devices. The average railroad management is desirous of getting the largest amount of traffic possible over its lines in the shortest possible time, and, incidentally, of doing this with the least amount of risk either to rolling stock or passengers and employees. But unfortunately there is a tendency to slight the second consideration in favor of the first. Certainly the cry of "safety first" has not been the ruling principle in railroad operation, and the Board is perfectly justified in its opinion that "the question of the actual design and construction of the apparatus necessary for automatic train control system has not been as great an obstacle in the way of its adoption as the operating question involved in its use."

The independent inventor working outside of the railroads, has done his part and done it well in producing several promising designs for automatic train control on steam railroads. The automatic stop has been proved to be a thoroughly practical device under the exceptionally dense traffic of the New York subway, where so far from limiting, it has greatly increased the number of trains that can be run over a given length of track in a given time with safety. The Block Signal and Train Control Board has shown, by test, that there are stops suitable for steam railroads which in its opinion if installed and actively developed by the railroads themselves, would soon be brought to a point at which they would satisfy all requirements of daily operation. Furthermore there is just now great activity, expert and otherwise, being shown in this field, and undoubtedly additional devices will be forthcoming for test by the Train Control Board.

It is evident that the question has reached the point where it is distinctly "up to" the railroads, and upon their attitude alone will depend the question of compulsory legislation by the Federal Government. It is certain that the railroads do not want compulsory legislation, and it is equally certain that they can prevent it only by a change of attitude and a sincere and earnest co-operation in meeting the unmistakable demand of the traveling public. The Board does not believe that at the present time legislative compulsion would be wise, but it does believe that the railroads should be urged and expected to develop the art of automatic train control, so as to provide devices which will meet their operating conditions. "This," says the report, "appears to the Board to be entirely practicable, *and should it not be done with a reasonable degree of expedition, steps should be taken by the Government to stimulate such action.*"

The case could not be more fairly stated. Let us hope that this may prove to be that word to the wise which is sufficient.

Agriculture in the Congo.—Since the Belgian government has been carrying out active operations in the Congo region, one of the interesting features is the agricultural work which is being carried on there, and especially the attractive botanical garden and establishment located at Eala where observations are made upon the native plants. The area now in use is about 500 acres, of which 200 acres are devoted to the botanical garden proper. The personnel consists of 8 specialists including an entomologist and a chemist, with 500 natives engaged on the premises. An annual fund of $30,000 is allowed.

Engineering

Installing Spillway Sluice Gates.—Several of the fourteen sluice gates required in the Gatun spillway have been put in position. These gates are massive structures of steel, 19 feet high by 47 feet 10¼ inches in length, each weighing 44 tons. They will slide vertically in steel grooves formed in the concrete piers which have been built above the crest of the spillway dam, and they will serve to regulate the height of Gatun Lake.

New York Erects Twelve Thousand Buildings.—During the past year some twelve thousand structures of various kinds were erected in New York Were they all dwellings for single families, the sum of $207,000,000 expended would furnish sufficient homes for a city of about 60,000 people. In Manhattan the sum of over $116,000,000 was invested in the construction of buildings. During the year, over $30,000,000 was expended on office buildings alone

Diesel Marine Engines of 24,000 Horse-power—It is authoritatively stated that the German navy is having constructed a twin-screw Diesel marine engine, which will consist of two sets of six-cylinder, double-acting engines, each set giving 12,000 horse-power, or 2,000 horse-power per cylinder To those who have closely followed developments, this information will cause no surprise, for the Germans have been making wonderful strides in the construction of oil engines of large size.

New Gyroscopic Compass a Success.—A board of naval officers appointed to test the new gyroscopic compass, which was installed experimentally on the destroyer "Worden," have found it to be remarkably free from oscillation due to the rolling and pitching of the vessel. Experiments which have been made with the same compass aboard a submarine show that it enables a helmsman to steer a more accurate course when the vessel is submerged

Turkey Sells Her Dreadnoughts.—All work has been stopped by Vickers, Ltd., of Barrow, on the construction of the Turkish dreadnought "Mahmed Reshad V" The vessel will probably be completed for some other power A sister ship under construction by Armstrong will also find its way into some other navy The Turkish cruiser "Drama," of 3,800 tons, has been sold to Italy for $1,000,000 There is no difficulty, in these days of feverish naval activity, in finding a ready market for warships

A 10,000 Horse-power Transmission Gear—A test has recently been made at the Vulcan Works, Hamburg, of a Föttinger hydraulic transmission gear of the great capacity of 10,000 horse-power This is one of two transmission gears which are to be fitted on a new German liner The plant underwent a continuous trial of two weeks' duration, night and day, under high load The turbine shaft is designed to run at 850 revolutions per minute and the secondary or propeller shaft at 170 revolutions. The transmitter ran smoothly without noise or vibration, reversing took place rapidly, and the efficiency obtained was close upon 90 per cent.

A Sun-power Plant in Egypt.—At Meadi, a suburb of Cairo, is a sun-power plant of unusual interest. It consists of five reflectors, each 204 feet long, whose cross-section is in the form of a parabola, with the generator units at the focus. The last-named are of zinc, built of rectangular sections 14 inches wide. To render them efficient, they are painted with a black paint of high heat-absorbing capacity The water is introduced at the lower end and the generator at its upper end is provided with a steam connection 4 inches in diameter The reflectors are lined with silvered glass mirrors. The plant works best at a pressure slightly below the atmosphere.

The New Quebec Bridge—The revised design for the Quebec bridge is so far advanced that details of the principal members are available. The main span is 1,800 feet long. The top chord members of the cantilevers will consist of double lines of 16-inch I-bars. The bottom chords will have the enormous dimensions of 7 feet height by 10 feet width The length from panel point to panel point will be 86 feet, each full panel of the bottom chord for one truss will weigh 200 tons. Each cast iron base for the towers will weigh 500 tons. The stringers reaching from panel point to panel point are massive plate girders 10 feet in depth, each weighing about 60 tons.

The Essential Feature of the Diesel Engine.—In the course of a paper recently read by him at Berlin, Dr Diesel denied that the essential feature of the Diesel process was the auto-ignition of the fuel. He stated that motors in which the auto-ignition of the fuel took place were in use before the Diesel process came into being, indeed, he had never laid a claim to auto-ignition in any of his patents. What he was aiming at was a process in which heat was utilized to the highest possible extent, and auto-ignition became embodied in the process incidentally during the evolution of the design. "The height of compression," said Dr. Diesel, "was not determined by the ignition limits of the fuel, but solely by the endeavor to obtain the highest possible figure for economical fuel utilization."

Electricity

Wireless Telegraph Station at the Vatican.—It is stated that a private wireless telegraph post is to be installed in the Vatican which will transmit to a considerable distance, and the Marconi wireless company has already furnished the first part of the apparatus The antenna will be set up in the gardens of the Vatican

Rathenau Medal Awarded to Edison.—On the evening of January 23rd at the American Museum of Safety, the Rathenau medal for the best electrical process or device for safeguarding life and health will be awarded to Thomas A Edison He will be the first American to obtain the prize It will be presented to him because of his storage battery, which provides a safe power supply for use in mines, submarine boats, and factories where explosives are made

Increase in the Use of Wireless Telegraphy—The annual report of the British Postmaster-General states that wireless telegraph messages sent to and from ships have increased 11.8 per cent beyond the previous year The increase is partly due to the larger number of vessels now equipped with "wireless" and partly to a reduction of tariff for vessels making short voyages. Nearly all of the wireless stations in Great Britain are now in the hands of the Post Office, the only private commercial stations being the Marconi stations at Clifden and Poldhu

Twenty-seven Years' Progress in Incandescent Lighting—An English electrical magazine publishes an interesting diagram showing the progressive reductions in the cost of the incandescent electric light which have taken place since 1885 The improvement has been twofold in the increasing efficiency and life of the lamp and in the reduction in the cost of current. It is probably not realized by the average consumer of electricity that whereas the first carbon filament lamps, supplied with energy at about 25 cents per unit and consuming 5 watts per (British) candle-power, gave only 200 candle-hours for 25 cents, with the best type of drawn-wire tungsten filament lamp to-day, supplied with energy at 8 cents per unit and consuming 1¼ watts per candle-power, the same sum of money gives 2 400 candle-hours

Replacing Reciprocating Engine-driven Generators by Turbine Units in England—In one of the generating stations of London it is proposed to "scrap" engines and generators only ten years old, and of 14 000 kilowatts aggregate capacity, because the present output of the station is insufficient to meet the demands of the tramways supplied from this station By replacing four reciprocating engine units of 1,500 kilowatts capacity each by four 8,000-kilowatt steam turbine-generators, the maximum output will be largely increased Two of the old sets will be changed at a time and it is estimated that the saving in coal will be over $57,000 for the first two turbines, which more than offsets the debt charges incurred by the change

A New Direct-current Steam Turbine-generator—The generation of direct-current electrical energy by the steam turbine-generator has been a problem on account of commutator difficulties at the high rotating speed at which the steam turbine should run in order to show a steam economy comparing favorably with the reciprocating engine. In the effort to solve this problem so-called "unipolar" steam turbine-generators having a highly simplified current-collecting device, and reduction gearing between the steam turbine shaft and the electric generator shaft, have been tried A new scheme for direct-current generation is now announced in the form of an alternating-current induction generator combined in one machine with a rotary converter In this "turbine converter" one member of the generator is mounted on the converter shaft and the other member (usually a squirrel-cage rotor) on the turbine shaft with the revolving field of the generator arranged to rotate the same way as the converter armature, giving a net generator speed equal to only a fraction of the turbine speed In a set of 500 to 600 kilowatts capacity the full-load efficiency is stated to be 94 per cent

Magnifying Feeble Signaling Currents.—Two interesting types of relay for submarine cable work, designed to improve on the "siphon recorder" invented by Lord Kelvin in 1867, were described at a recent exhibition of electrical apparatus in London The problem of high speed working is to cause very feeble transient currents to make distinct records. In one of the new devices the object is attained by mechanical means. The suspended coil of the relay has two silk fibers running to and around a rotating spindle. The slight movement of the coil in either direction, by slightly increasing the friction of one or the other of the fibers on the rotating spindle, causes the latter to supply a supplementary force many times greater than that exerted by the coil itself The other device virtually magnifies the feeble arriving current by thermo-electric means. The suspended coil carries an arm at the end of which are two tiny thermo-electric couples forming a T between two little alcohol flames. The slight movement of the coil, by turning one or the other of the thermo couples toward one flame and away from the other, generates a current in the one direction or the other 27 times greater than the received current.

Science

A Swiss National Park.—A magnificent national park, the largest in Europe, is about to be established in the canton of Grisons, Switzerland It will ultimately have an area of nearly 80 square miles, all of which will be wholly withdrawn from human interference and set aside as a biological preserve

Changes in the Map of Greenland—A series of maps presenting the results of the surveys carried out by the ill-starred Mylius Erichsen expedition of 1906–08 to northeastern Greenland has been published in the *Geografisk Tidskrift* These show that Greenland extends much farther east than was formerly supposed, and add about 150 000 square miles to its area.

Amundsen's Proposed North Polar Journey has been postponed for a year, at the suggestion of the Norwegian government, seconded by Prof Nansen, in order to give the staff more time for thorough training in oceanography, the subject to which the expedition will devote principal attention Captain Amundsen is to be presented with a gold medal for his discovery of the South Pole, at the annual banquet of the National Geographic Society, in Washington January 11th

A Princely Bequest to Science—The will of Albert Samson, who died recently in Brussels, bequeathed the bulk of a large estate for scientific researches Two endowments are created, one under the control of the Royal Prussian Academy of Sciences the other to the Royal Academy of Sciences at Munich The Prussian endowment is worth $500,000, the Bavarian $100,000 The Berlin endowment is to carry out scientific researches into individual as well as social ethics The endowment for the Munich Academy has a similar purpose

French Expedition to Morocco.—The Geographical Society of Paris, aided by the French Academy of Sciences, the National Museum of Natural History and a number of banking institutions, has organized an expedition which will carry on elaborate scientific explorations in Morocco for four or five years, and perhaps longer The party is made up of well-known specialists in several fields, including M Gentil who will have charge of geology and mineralogy, M Baugnil in charge of agronomy, M Pallary, zoology, and Prof Pitard, botany

An Institute to Study Fuels.—Under the auspices of the Kaiser Wilhelm Scientific Society there has been founded an institute for research upon combustibles The buildings of the institution are to cost $150 000, and the State allows an annual endowment of $30,000 Another endowment coming from the mining syndicate of Westphalia and the Rhine amounts to $25 000 and the above-mentioned society itself contributed the sum of $5 000 It is stated that the buildings of the institution will be opened for use early in 1914 and the director is to be Prof F Fischer, of the Berlin Hochschule

Changes in the Weather Bureau The River and Flood Division of the Weather Bureau, which has charge of the important work of stream-gaging and river-stage prediction, has been placed under the direction of Prof A J Henry, lately in charge of the Mount Weather Observatory He is succeeded at the latter institution by Dr W R. Blair Three officials of the Bureau have recently been promoted to the grade of professor of meteorology, viz, Dr O L Fassig the well-known climatologist, now in charge of the station at Baltimore, J Warren Smith, a specialist in agricultural meteorology, who is stationed at Columbus O, and W M Wilson, stationed at Ithaca, N Y C Fitzhugh Talman librarian and supervising examiner of the Bureau and W R. Blair, of the Mount Weather Observatory have been appointed junior professors, a new grade in the service.

The Sphygmomanometer is an instrument of recent invention for measuring the blood pressure The name is derived from *sphygmos*, the pulse, *manos*, thin rare, and *meter* a measure The manometer had been in use for some time as an instrument for measuring the tension of gases and vapors, and was readily adapted to testing blood pressure by adding a rubber bulb and a cuff with rubber bag attached on the inside This is placed over the brachial artery, above the elbow, and when the pressure through the rubber bulb has shut off the artery so the pulse cannot be felt at the wrist, the reading in the graded scale at the height of the column of mercury indicates the blood pressure The normal blood pressure is 125 millimeters In hardening of the arteries, and accompanying heart and kidney complications, the blood pressure is an important symptom to be studied Several of the large life insurance companies require the blood pressure to be taken in applications for large amounts One company requires it in all applicants without regard to age or amount This company claims to have saved $50 000 in losses the first year in which they required the use of the sphygmomanometer They followed the history of cases rejected on account of high blood pressure only, and found several who died within the year of apoplexy.

Moving and Talking Pictures

MOTION pictures are at the present time usually exhibited by optical projection, enlarged images of pictures carried by a long strip of film being thrown upon a screen or curtain. This process is to a large extent the reverse of that employed in taking the pictures, to effect which reduced images of the scene which is to be reproduced are allowed to fall in succession upon a sensitized film. In the apparatus commonly employed for obtaining the pictures snap-shots are taken at the rate of sixteen per second upon the film which is intermittently moved. A rotating shutter provided with an opening allows sixteen images per second to fall in succession upon the film. The apparatus is so constructed that the film is held stationary while each picture is taken and then is moved forward at a high rate of speed into proper position for the next picture, this movement occurring at the time when the shutter is so positioned as to protect the film from the light. The film carrying the exposures is developed, and from the negatives thus obtained prints are made upon a similar strip of film for use in the projection apparatus. This apparatus is usually similar to the camera except that a powerful light is provided to throw successive images of the pictures upon a screen. These images are enlarged by means of an objective lens, and appear upon the screen in such rapid succession that before one picture has time to fade from the retina of the eye another one is in view. Since each picture is slightly different from the preceding one and since the pictures blend imperceptibly into each other, the illusion of movement is produced, and the observer sees the original scene re-enacted.

On August 24th, 1891, Thomas A. Edison filed two applications for patents, one of which became patent number 493,426, dated March 14th 1893, and, therefore expired on March 14th, 1910. The apparatus disclosed in this patent involves a cabinet having a sight opening across which the picture film is continuously moved, each picture being momentarily illuminated when it is accurately centered with relation to the sight opening. This device is not adapted to project pictures and provides for only one observer at a time. A device of this character was for a time in extensive use, but it has now been largely replaced by the projector. The other application referred to matured into patent number 589,168 on August 31st, 1897, and consequently does not, or rather the reissues which have superseded it do not expire until August 31st, 1914. The device covered by this patent is intended only for taking pictures, but is, however illustrative to a large extent of the principle both of the camera and the projector commonly used. The apparatus is shown in Figs. 1 and 2. The film 3 passes the lens tube on its way from the reel 1 to the reel 2, being drawn along by two feed wheels 5, the teeth of which engage perforations placed along each side of the film. The film would move continuously were it not that the rotation of the feed wheels is periodically checked by the interaction of two toothed wheels, the one 25 mounted on the main shaft 26 and the other 23 on the feed wheel shaft 6. One tooth of the wheel 23 is allowed to escape at a time, and thus the film is intermittently advanced. Mounted on the shaft 26 to rotate between the film and the lens tube is a disk 11, which is apertured to permit the light rays to fall upon the film each time the latter stops.

Although present machines differ from this machine yet certain features have been used in various machines. This patent has, therefore, been made the basis for litigation. The Court of Appeals of the Second Circuit (114 F R., 926) held claims 1, 2, 3 and 5 of this patent invalid on account of being broader than the state of the art warranted. Claim 1 covered the combination of three elements (1) any means capable of intermittently projecting at such rapid rate as to result in persistence of vision images of successive positions of the object or objects in motion as observed from a fixed and single point of view, (2) a sensitized tape-like film, (3) any means for so moving the film as to cause the successive images to be received thereon separately and in single line sequence. The scope of the second claim was the same except that it was limited to a single camera with a single lens. The third claim differed from the second only in that it was restricted to intermittent motion of the film and exposure of the film during the periods of rest. The court based their decision on the following four references. The French patent to Ducos of 1864 describes a camera having a large number of lenses caused to act in rapid succession upon a series of sensitized plates or a surface of sensitized paper. The lenses and the sensitized surface move continuously at the same rate of speed while the picture is taken, one lens after another passing an aperture which admits light. The images are formed from the same point of view—the single aperture. U. S. patent to Le Prince, 376,247, January 10th, 1888, discloses a camera provided with a battery of sixteen lenses which act upon two strips of sensitized film placed side by side. The lenses are provided with shutters, eight of which facing one film are operated in rapid succession. The eight facing the other film are then operated, during which time the first film is moved into position to receive another eight exposures and so on. Unlike the Ducos camera, the lenses in this device are fixed and, therefore, the pictures are not all taken from the same point of view. The photographic gun of M. Marey, described in the SCIENTIFIC AMERICAN SUPPLEMENT of June 10th, 1882, discloses a single lens camera which takes twelve pictures in a circular series around a sensitized plate rotated behind a slit which allows entrance of light. The plate is rotated intermittently by clock work arranged to give one rotation with twelve periods of rest. The number of exposures for one operation is limited to twelve. Mr. Levinson in the *Brooklyn Eagle* of June 14th, 1888, described a camera for taking motion pictures in which a single lens is employed to obtain images on plates carried by an intermittently operated wheel, each plate being exposed while at rest. He stated further that the mechanism employed to drive the plate carried could be employed to operate a continuous strip of paper or a film carrier. The court held that in view of these references the invention of Mr. Edison was not in such sense a primary one as to authorize the claims on which suit was brought. In regard to the prior art they stated in particular that he was anticipated by Marey in an apparatus capable of producing negatives and embodying means for passing a sensitized surface across a single lens camera at a high rate of speed and with intermittent motion and for exposing successive portions of the surface during periods of rest. The fifth claim of the patent, which was for a film having the photographs thereon was also held invalid in view of the references. Claim four of the patent was not included in the suit and was not passed upon by the court in this decision.

After the patent had been adversely passed upon it was reissued in two parts. Reissue No. 12,037 for the camera and reissue No. 12,038 for the film. The reissue for the camera contained four claims, the first three being more limited than those in the original, while claim 4 was the same as claim 4 of the original. Claim 1 contained four elements (1) a single stationary lens, (2) a single sensitized tape-film supported on opposite sides of and longitudinally movable with respect to the lens, and having an intermediate section crossing the lens, (3) feeding devices engaging such intermediate section of the film and moving the same across the lens of the camera at a high rate of speed and with an intermittent motion, (4) a shutter exposing successive portions of the film during the periods of rest. Claim 2 also included a continuously rotating driving shaft, by which the feeding devices and the shutter were operated. It limited the shutter to a continuously rotating shutter. Claim 3 differed from claim 2 in omitting reference to the shutter as being continuously rotating and operated by the shaft, and included a reel for winding

(Concluded on page 84.)

Fig 1 and Fig 2 (insert).—Edison projector

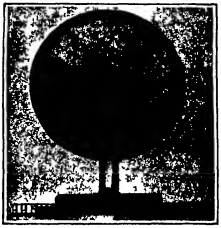


Fig 3.—Segmental mirror of Gray's machine.

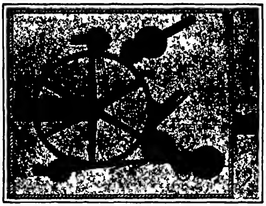


Fig 4.—Gray's moving picture apparatus.

Fig 5.—Marey's photographic gun.

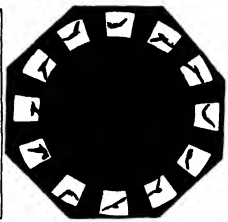


Fig 5a.—Plate used in the Marey gun.

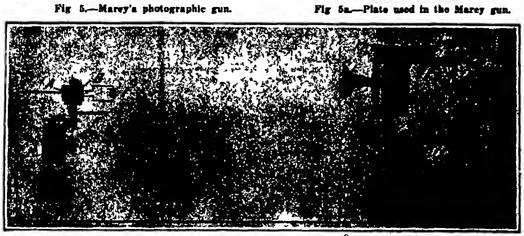


Fig 6.—Gaumont moving and talking picture apparatus.

A Successful Automatic Train-stop

A Device Which Saves the Train, Reports Disregard of Signals, and Thereby Stiffens Discipline

IN the fourth annual report of the Block Signal and Train Control Board to the Interstate Commerce Commission in December, 1911, there occurs this paragraph "The Board has no hesitancy in saying that, had the railroads directed the same efforts toward the development of automatic train-control apparatus that has been devoted to the development of interlocking and block-signalling apparatus, we should now have adequate installation of automatic train-control devices, which would permit an engineman to handle his train without interference as long as he did it properly, but would intervene to stop his train if he disregarded a stop signal or ran at excess speed, where speed restrictions were prescribed."

During the past fifteen years the SCIENTIFIC AMERICAN has repeatedly drawn attention to the growing number of fatalities and injuries on our railroads, and for many years we have urged the use of the automatic train stop as a salutary check upon disobedience of signals and a most effective safeguard of the lives of passengers. Unfortunately, the railroad companies, for various reasons, have been opposed to the train stop, and with a few exceptions it is only recently that they have begun to give it unwilling attention. A few roads, operating under special conditions, have installed the stop, and in such cases, particularly on the New York subway, it has proved to be a brilliant success. To-day some roads are testing out devices of this kind that have been developed on the outside, and one railroad has recently made the offer of a reward, the conditions of which will be found on the correspondence page of this issue in which it solicits the assistance of the outside public in the solution of the problem

The success of the mechanical trip train stop, as used on the New York subway where, during several years of operation on express trains under a headway of one minute and 43 seconds, there has been only one failure out of 277 846 movements, proves that, when it is installed in subways or under conditions such as those on the Boston elevated road, where it is not subject to attack by snow and ice, this type of stop is thoroughly reliable.

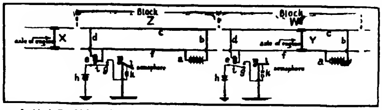
For use in the open on steam railroads, however, where the mechanism both at the rail and on the train will be subject to destruction or disarrangement by snow and ice, or by trespassers on the tracks or intentional train wreckers, the problem is more difficult and modifications become necessary In all probability it will be found that the most satisfactory system is one which operates electrically upon what is known as the "closed circuit" system, and dispenses altogether with projecting mechanical parts which are liable to be injured or entirely carried away in the stress of day by-day railroad operation. Also, it may be taken for granted that the successful, electrically-operated device must form part of or co-act with the track circuits which operate the standard block signals as installed on our railroads.

It is necessary that anyone who undertakes to solve this problem should have a clear understanding of the operation of the electrically-controlled automatic block signal system To this end we have prepared the accompanying diagramatic view showing its basic features, which consists of a track battery a furnishing a low voltage electric current through wire b, to one line of track rails c at the end of a block Z, which is isolated by means of insulated joints from the adjoining blocks, a wire connection d to a relay e, which is energized by the current as thus supplied and the other line of track rails f closing the return circuit to track battery a The relay being thus energized, attracts the armature i and makes the contact g This permits current to flow from a signal battery or other source of power h to the signal magnet or motor k, which holds down the semaphore l against the action of the counterbalance m, which normally holds the semaphore in the horizontal or stop position A train X approaching block Z, observes that the semaphore is in the downwardly inclined position and has the right to proceed into the block Z

If a train Y occupies block W, the front axle of the train short-circuits the track current, the relay is de-energized, and it no longer holds the armature against the contact. Thereupon the signal magnet or motor, as the case may be, is deprived of current and the counterbalance weight m automatically draws the semaphore into the horizontal or stop position warning the approaching train that the block is occupied A broken rail interrupting the flow of current in the track circuit or any defect in the apparatus that breaks the circuit, de-energized the signal magnet or motor k and allows the semaphore to go to the stop position.

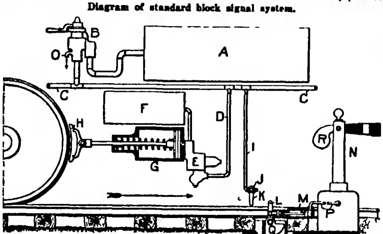
This method of controlling the signals is known as the "closed circuit" principle It is essential in the safe operation of a system which must err on the side of safety should anything go wrong Every successful automatic stop must be arranged on this same closed-circuit principle, it must be included in the circuits which control the block signals, its movements to clear or stop must be coincident with those of the signals, and any failure of the circuits or mechanism must cause it to be drawn by gravity to the stop or danger position

Now the same broad principle is followed in the automatic airbrake (see diagram) The main reservoir A on the engine, the train pipe C which runs the full length of the train the auxiliary air reservoirs F on each car are normally maintained under full air pressure When the engineer opens the brake valve B the pressure in the train pipe C and branch



In block Z, which is clear track battery a through circuit b c d f relay e contact g and signal battery h, causes magnet k to lower semaphore l In block W engine axle Y short-circuits track-current l is released and raised by counterweight m to stop position.

Diagram of standard block signal system.



A, main reservoir B, engineer's brake valve C, train pipe. D, branch pipe E, triple valve F, auxiliary reservoir G brake cylinder H, brake shoe I, trip branch pipe. J, trip valve K, trip valve lever L trip M trip piston N signal O, exhaust from train pipe P, air pipes. Q, stop counterweight R signal counterweight

Relation of automatic signal and stop to train brakes.

Home and distant signals clear, stop lowered.

Stop raised opens valve on pipe and sets brakes.

Counterweight in box raises stop when signal is at danger.

AUTOMATIC SIGNALS AND STOP AS USED IN NEW YORK SUBWAY.

pipe D is reduced, and this causes the triple valve E to admit air from the reservoir F to the brake cylinder G on each car, thereby setting the brakes. Any failure of the air pressure, as in case of a train breaking in two causes the brakes to be automatically set. For automatic stop setting of the brakes, a trip branch pipe I is led down from the train pipe and terminates in a trip valve J provided with a trip lever K, which is so placed that it will engage with a trip L, when the latter is in the raised or stop position.

The mechanical trip as installed in the New York subway and elsewhere is shown in the diagram and in the three photographic views. It consists of a short lever placed adjacent to the track rail, which is normally held down clear of the trip valve lever K by the compressed air piston M. The valves admitting compressed air to the back of this piston and to the piston operating the signal N are controlled by electro-magnets in the signal circuit, as described above. Normally, the trip, like the signal, is maintained in the clear position but when the block is occupied, the air pressure back of M is released and the trip rises to the stop position under the action of the counterweight Q.

Now it is evident that the weak point, if there is one, in this system is the possibility of a failure of the trip to register with the trip valve lever, either through one or the other being broken entirely off or twisted, or through their movements being obstructed. In the New York subway or on the elevated, this possibility is very remote but in the open on steam rail roads, especially during the winter months, it might well happen. If there were such disarrangement, the engineman would be unaware of it. Herein lies considerable peril, and it is for this reason, among others, that railroads operating in the open have been opposed to the mechanical stop. To quote one of the leading railroad engineers in the country "If an automatic stop is to be generally employed on American railroads, it must be certain in its action, and this means that it must be constructed on the closed-circuit principle, a failure in the co-ordination in the parts of which must be just as certain to stop the train as a fractured rail or a defect in the apparatus will bring about a stop indication of the signal semaphore"

In the presence of this dilemma, the thoughts of inventors have naturally turned to electricity and the substitution of electrical contacts for mechanical stops. One system the Lacroix, using a third rail contact and a closed electrical circuit in the cab, after undergoing a series of tests by the Block Signal and Train Control Board, received the following endorsement "The test indicated that the apparatus could be expected to operate satisfactorily under severe weather conditions. The system with reasonable inspection and maintenance would be safe, reliable, and its use would tend materially to promote safety of operation on a railroad using it" We quote this case to show how entirely without justification is the contention of the steam railroads that there is no automatic stop in existence or in sight, that will meet the severe requirements of daily out of doors operation.

Admitting as essential to a successful stop the principle that the whole apparatus—track circuit, engine circuit and the contact relations between the two—must be upon the closed-circuit principle, detecting its own failures and incapable of giving a false "clear signal," this problem becomes a most interesting and attractive one, capable of a wide range of variation in its solution The automatic train stop has come to stay Its necessity is becoming increasingly realized, and it is to be hoped that the railroads generally will change from an obstructive to a favorable attitude, and that the train stop will be adopted voluntarily and widely and without any resort to Federal legislation.

The Death of Dr. Lewis Swift

ON January 5th Dr Lewis Swift, one of the great astronomical observers of our time, died at Marathon N Y at the ripe age of ninety two. He was chiefly noted for his work on nebulæ, of which he discovered 1,240 his studies of comets of which he discovered 14, his investigations of shooting stars, solar eclipses and possible intramercurial planets. It is said that his first interest in astronomy was aroused by reading Dr Dick's books at a time when he was in business. He made his reputation with the discovery in 1862 of the great comet that bears his name, a discovery that resulted in his removal from Hunt's Corners to Rochester There, on the roof of a cider mill he set up an humble observatory where he discovered comet after comet and nebula after nebula Much of this work was done while he was in business in Rochester

Blackening Tan Leather

TO blacken tan leather it should be first rubbed with a ten per cent solution of tannic acid. Let this solution dry thoroughly, when a ten per cent solution of iron sulphate should be applied. This gives an intense black, is easily applied and is harmless to the operator

Teams and Motor Trucks Compared

By H. W. Perry

THE front page illustration tells its own story so plainly that it is almost unnecessary to amplify it. Some of the advantages of the motor truck over the team drawn wagon may be thus summarized

The average distance covered per day by a two-horse team varies between 16 and 20 miles, whereas the average distance covered per day by a three or five-ton motor truck varies between 40 and 60 miles. Horses and wagons could serve daily an area of 314 square miles on a ten mile radius, on the other hand motor trucks, operating on a 25-mile radius, would cover 1,963 square miles.

The work done by a two-horse team per day varies from 48 to 60 ton-miles. On the other hand, motor trucks of from three to five-ton capacity perform an amount of work measured by 165 to 225 ton-miles per day

At \$8.50 per day, the cost per ton-mile of hauling by team is 17 7 to 14.16 cents, but the cost per ton mile of hauling by three or five-ton motor trucks at \$12.25 to \$15.60 per day is 7 42 to 6.88 cents.

Equally remarkable is the amount of space occupied by the horse-drawn truck as compared with the motor truck. A team and wagon is about 26 feet long, a three to five-ton motor truck, 20 feet long, a four-horse team and wagon is about 39 feet long, and a ten ton motor truck, its horse-drawn equivalent, only 25 feet long. So far as areas are concerned an ordinary team and wagon will occupy 182 square feet, but a three to five-ton motor truck only 140 square feet.

In the matter of storage space required for gasoline and feed the motor truck engine displays an advantage. An amount of hay and oats sufficient to feed a team for one month occupies a volume of 100 cubic feet, but the gasoline required for a motor truck for one month will occupy only twenty cubic feet. The cost of hauling by motor truck is incomparably cheaper than by horse and wagon. Thus, the cost of hauling 1,000 tons ten miles by horse and wagon is \$160, but only \$70 by motor truck

The amount of work performed by one motor wagon is equivalent to the amount of work performed by three and one half average teams. To haul 585,000 tons an average distance of one mile in a year, would require 100 teams, but 39 motor trucks would theoretically be required to haul the same load an average distance of one mile in a year

The cost of keeping and using 39 teams and wagons per year would be \$99,450, but the cost of keeping and using ten motor trucks would be only \$42,000.

Judging by the registration of horse-drawn wagons in Chicago, the use of horse-vehicles is decreasing at the rate of 15.8 per cent per annum. In other words 68,000 horse-drawn wagons were registered in Chicago in May, 1911, and only 53,600 in September, 1912. On the other hand the use of motor trucks is increasing at the rate of 120 per cent a year, this estimate being also based on Chicago statistics. It seems that the number of motor wagons registered in Chicago in May, 1911, was 800, and the number in September, 1912, 2,094.

Brontidi

IN this week's SCIENTIFIC AMERICAN SUPPLEMENT Mr. C. Fitzhugh Talman gives an account of some curious acoustic phenomena which have been generally called "brontidi," "mistpoeffers," or "Barisal guns," but which bear scores of other names in various parts of the world. They take the form of muffled detonations, resembling the sound of distant cannon or peals of thunder, and are heard chiefly in warm, clear weather

The first systematic investigations of these phenomena were made in India. The fact that they were frequently reported from the neighborhood of Barisal, a town in the Ganges delta, led to their being called "Barisal guns," under which name they were first made known to European science at the meeting of the British Association in 1890. A few years later they were discussed in an extensive memoir by E. van den Broeck, who had collected numerous reports of their occurrence in Belgium, where they are known as "mistpoeffers" (i. e., "fog-belchings" or "fog-hiccups") The most extensive literature on the subject, however, has come in recent years from Italy, where the sounds appear to be extremely common, though very local in their distributions, they are well known in some localities, but entirely unknown in others not far distant. They are popularly known under a great variety of names in Italy, but since 1904 have been generally called by Italian scientific writers "brontidi"—a conveniently non-committal term formed by Prof. Tito Alippi from two Greek words meaning "like thunder." (This is likely to become the international name, with or without changes in termination to suit the various languages, i. e., "brontides" in English and French) In Australia the noises are called "desert sounds," in Haiti, "gouffre," etc. They have been reported from some parts of the United States, especially California. It is difficult to define their distribution, because, except in places remote from human habitation, they are likely to pass unobserved—being taken by most people for actual discharges of cannon, blastings, explosions, and the like.

When once the attention of the world had been directed to the widespread occurrence of brontidi it was found that there are rather numerous references in early literature to apparently the same phenomena. Thus Lord Bacon speaks of "an extraordinary noise in the sky when there is no thunder"

The latest views as to the origin of brontidi are summed up as follows

"Many suggested explanations that seemed more or less plausible when the problem was viewed as a local one—as in the early discussion of Barisal guns—are invalidated by the wide range of physical conditions under which the phenomenon is now known to occur The trend of recent opinion is toward looking upon the source of brontidi as subterranean in most cases, though perhaps not in all. Movements within the crust of the earth must frequently set up vibrations of such amplitude as to affect the ear, when communicated to the overlying atmosphere. Assuming the focus to be far below the surface, the air would be set in vibration over a wide area, giving the indefiniteness as to the direction of the sound that is commonly noted. Prof W H Hobbs, who has made a painstaking study of the seismic geology of Italy, concludes that the brontidi of that country are due to the slow settlement of orographic blocks, and the consequent production of vibrations within their marginal zones."

Whatever the initial cause of the sound, its audibility appears to depend upon definite acoustic conditions that require further investigation. Alippi believes that in order that the sounds may be heard they must be re-inforced by a peculiar configuration of the ground, above or below the surface, and he attaches special importance to the effect of caverns, which he suggests act as resonance boxes in the production of audible brontidi.

A New Industrial Process for Manufacturing Oxygen

By Our Berlin Correspondent

DR. G KASSNER, professor at Münster University, has designed a new process for the manufacture of oxygen which is based on the Tessié du Motays process but, thanks to the absence of any antagonistic effects, lends itself to a far better industrial application than any chemical method so far suggested. Kassner adds to the alkali manganates used in the Tessié du Motays process an alkali salt of metaplumbic acid, thus increasing enormously the efficiency and constance of the mass. The process comprises two phases characterized by the action of currents of steam and air, respectively During the first phase the alkali given off by dissociation is immediately absorbed by the alkali metaplumbate, thus forming orthoplumbate. Inversely, during the second phase, which is that of regeneration, the alkali absorbed by the metaplumbate is given back to the residual manganese oxide, thus forming alkali manganate. This is how the formation and decomposition of the manganate due to the addition of metaplumbate (which eliminates any disturbing antagonistic effects) takes place in continuous succession, without any appreciable alteration in the composition of the mass.

In opposition to physical processes which only utilize indirectly the heat units given off by the fuel, this chemical process works without any appreciable heat losses. It is carried out in the following manner

After being introduced into a suitable apparatus refractory to heat and insuring a constant temperature, the active mass is, by means of a special fire-place, raised to and kept at the relatively low temperature of reaction of about 400 deg. Cent. A mechanically controlled valve causes separate currents of steam (exhaust steam, etc.) and air to enter this mass, at short intervals of equal duration. By inserting a very short discharging phase between the air and steam phases, any nitrogen left after regeneration in the pores of the mass is eliminated. The oxygen produced during the steam phase is led automatically into a gasometer set apart for this purpose. Moreover, a recovering apparatus serves to transmit any heat units escaping with the nitrogen, to the currents of air and steam entering the apparatus, thus preventing as far as possible any loss of heat. Finally, the process is so designed that the charge can be exchanged readily and easily, without any interruption in service worth speaking of, should it after some considerable time's working show any decline in its output which, however, will only happen exceptionally. As, in fact, the active mass remains constant in quality as well as quantity, it will at most require (after protracted working) a mechanical regeneration, restoring it to its previous porosity.

In view of the relative insensitiveness of the mass to the moisture of hot air, the new process would seem to lend itself for metallurgical applications.

The N. Y., N. H. and Hartford Railway's Automatic-stop Prize

Conditions That Must be Observed in the Competition for the $10,000 Award

THE New York, New Haven and Hartford Railroad Company has offered a reward of ten thousand ($10,000) dollars to whomsoever shall invent, perfect, and submit the best automatic device that will safely arrest trains disregarding fixed signals.

The reward will be paid on the order of the Interstate Commerce Commission, the Railroad Commissioners of Massachusetts, and the Public Utilities Commissioners of Connecticut.

Conditions of Competition.

1 Competitors must submit a typewritten or printed description of their device, describing in full all features wherein the device does or does not conform with the requirements as herein below set forth, in consecutive order

2. Any device which in the judgment of the Signal Engineer of the New Haven Company does not satisfactorily meet the essential requirements, will be rejected and if it is the desire of the competitor to have the device developed further, it will be done at his sole expense

3 Any device appearing, in the judgment of the Signal Engineer to have sufficient merit or promise to justify more extended consideration, the Railroad Company will assist Competitor by contributions of money or use of tracks, or both, in such measure as deemed reasonable

4 Any device after meeting the requirements, must show an efficiency equal to that of the signal system in use on railroads at the present time before same will be accepted.

5 Any device accepted will remain the property of the Competitor or Patentee, subject however to the reservation by the Railroad Company, of a right of use without further payments.

6. Before any device is accepted it must be adopted for general use by either the New York, New Haven & Hartford the Pennsylvania or the New York Central Railroads, within the year 1913, 1914, or 1915

7 The device must also have the approval of the Interstate Commerce Commissioners, the Railroad Commissioners of Massachusetts, and the Public Utilities Commissioners of Connecticut.

8 Those desiring to enter this competition must file their application before July 1st, 1913.

Requirements of Stopping Device.

CHARACTERISTICS AS PUBLISHED BY THE TRAIN CONTROL BOARD OF THE INTERSTATE COMMERCE COMMISSION

1 The apparatus should be so constructed that the removal or failure of any essential part would cause the display of a stop signal, and the application of the train brakes.

If electric circuits are employed they should be so designed that the occurrence of a break, cross, or ground or a failure of the source of energy in any of the circuits, should cause the display of a stop signal and the application of the train brakes.

2 The apparatus should be so designed that it may be used on the open railway on bridges, on elevated structures, in tunnels or subways, and where either steam or electricity is used as a propelling power

3 The apparatus should be so constructed as to conform to recognized standards of clearance of rolling equipment and structures, so that those portions of the apparatus placed on the roadway will not be subject to damage by rolling stock or engines, or those portions placed in the vehicle be damaged by structures permitted to exist on the roadway and at the same time all vehicle parts and roadway parts which may have to come into operative relation with each other should be so designed that proper operative relation will be assured under all conditions of speed weather wear of tracks or vehicles, oscillation, and shock

4 The system should operate under all weather conditions which permit the operation of trains

5 The system should be capable of control by ordinary means used for indicating the condition of the block about to be entered, such as electric track circuit

6 The engine apparatus should be so constructed as to prevent the release of the brakes after the application has been made until the train has been brought to a stop, or obstruction or other condition which caused the application has been removed

7 The system should be so designed that should operating conditions require it, speed control may be used that is, provision made for a train to pass an automatic stop in tripping position without the application of the brakes provided the speed is less than a predetermined number of miles per hour

8 The system should be so designed that when no cause for stopping a train exists, a definite and positive or proceed indication will be given at every point where a stop indication would be given or the brakes applied, when adverse or dangerous conditions exist.

9 The system should provide at least for use under congested traffic for the continuous display of indications rather than for their intermittent display at certain definite points, as of course is necessary with fixed signals.

10 The apparatus should be so constructed and installed that it will not constitute a source of danger to trainmen or other employees, or passengers

In addition to above, the following additional requirements must be met

11 The apparatus should be non inductive so that its application to a railroad where alternating current electricity is used as a propelling power it will not affect same

12 The apparatus should be so constructed that it may be used with either absolute or permissive operation also to cause trains to reduce speed at points where a reduction of speed is deemed advisable for safe operation of trains.

13 The apparatus should be so constructed that it will not be made inoperative by snow ice sleet or freezing conditions.

14 The apparatus should be so constructed that two or more engines may be used with one train or a train may be allowed to assist another train without causing the brakes to be set on the second or following engine when passing a signal which indicated proceed when passed by head of train

15 The apparatus should be so constructed that the automatic stopping device shall be operative only in the normal direction of traffic except in connection with signals governing reverse movements.

16 The apparatus should be so constructed with speed control device that a train may pass an automatic stop in stopping position without brakes being applied provided the speed has been reduced to less than a predetermined number of miles per hour

17 The apparatus should be so constructed that with speed control device applied, brakes can be released by engine or train crew after they have once been set by the stopping device provided speed has been reduced to a predetermined number of miles per hour

18 The apparatus should be so constructed that if found desirable proper apparatus can be provided on the engine to record the number of times the automatic stopping device has been applied to the brakes.

Rusting of Iron

IN some very interesting experiments by two German chemists, E. Liebreich and F. Spitzer, the cause of rust in cases which have seemed especially puzzling has been made very clear—as it was shown beyond question that the rust was caused by the paints themselves. They painted polished steel plates, and in order to distinguish them, numbered them with oil paint. The result was that the rusting took place just under the painted numbers—that is, where the "protective" coating was the thickest.

They went further in the matter, and examined iron business signs and the like. As a rule these were made of sheet iron, first painted with a ground color—mostly white, then the lettering was added, usually in black. Removing the coating, it was shown that the rust was most pronounced under the lettering, in fact in most cases was to be found only there.

This set the investigators to thinking, and they carried out their experiments with several kinds of paint, as follows

White lead.
Zinc white (purest zinc oxide)
Red lead
Iron oxide
White lead and lampblack.
Zinc white and lampblack.

Iron plates were brightly polished and four plates coated with the above paints, in different thicknesses of each, one plate getting but one coat, a second two, a third three, and a fourth four, time for drying being accorded. Then all the plates were subjected for a whole day to the action of the steam from water boiling in an open vessel (that is, under no pressure above that of the atmosphere)

The paint was then dissolved off to show the condition of the plates.

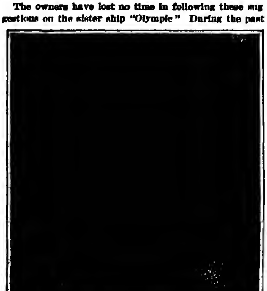
The result was surprising. Under all the single coatings the iron was not at all rusty; under the double coat, partly attacked, under the triple coat, more strongly, and under the four coats, thoroughly rusted!

Apparently one coat—at least of the above-named paints—is better than more. The explanation of this remarkable result would seem to be that the varnish in the second coat dissolves and loosens the first one, making it porous, and that the oftener this process is repeated, the more porous the paint becomes. It would also seem to indicate that one thick coat, if allowed to harden, would be better than several thin ones—which has not been considered to be the case. There seem to be no experiments in this particular on record.

Reconstruction of the "Olympic"

IT will be remembered that the investigations of the loss of the "Titanic," led to the widely-accepted conclusion that, although the construction of the ship was of the highest character as to material and workmanship, she was deficient in underwater protection It was recommended, both by the Senate Committee which investigated the disaster and by the Board of Inquiry under Lord Mersey, that certain structural changes should be made, chiefly below the waterline which would render ships of a design similar to the "Titanic" safe, if not against foundering under any conditions, at least against their foundering under a collision as serious as that which sank the great ship. The most important recommendation was that future ships should carry an inner skin, either in the form of plating on the inside of the main frames of the vessel, or in the form of longitudinal watertight bulkheads, built several feet inboard, which would form the inner walls of the bunkers and extend throughout the boiler spaces.

The owners have lost no time in following these suggestions on the sister ship "Olympic" During the past winter the "Olympic" has been withdrawn from service and extensive reconstructions have been made at the Belfast yards. The principal change has been the carrying of the plating of the double bottom up the sides of the ship, as far as deck F Below the lower deck, the inner skin, as thus riveted upon the frames, will be about 2 feet 6 inches distant from the outer skin of the ship Between the lower deck and deck F the skin will be about three feet inboard



By courtesy of [illegible]
Sketch showing how the floor-plating of the "Olympic" was carried up the sides of the ship to form an inner skin
Increasing the underwater protection of the "Olympic."

The importance of these changes will be readily appreciated and the nature of the construction understood, by reference to the accompanying sketch which shows conditions in the ship as originally built and as they will be when the inner plating has been completed. Formerly a rupture of the outer skin admitted water entirely across the ship. In the future a rupture of this outer skin, unless the penetration were very deep, would admit the water only to the cellular space between the two skins.

Another improvement, which will add greatly to the safety of the ship, is that additional watertight bulkheads have been constructed fore and aft of the boiler spaces, some of which have been carried up to B deck forty feet above the waterline The White Star Company is to be congratulated upon the promptness with which it has recognized the lesson of the loss of the "Titanic" and taken steps to thoroughly insure her sister ship against any such disaster

Artificial Sponges of Paper

WHEN paper pulp is treated with zinc chloride there results a viscous mass. Sodium chloride (or ordinary table salt) is added to this the mass is then thoroughly rinsed with alcohol and is finally submitted to the action of a press whose platform bristles with a number of fine metallic points or projections. These penetrate the mass forming tubes like those in an ordinary marine sponge known as *canaliculæ*"

The block thus obtained is of a spongy consistency and is both insoluble and unalterable in water It is smooth and pleasant to the touch and is not susceptible of putrefaction It is a very ingenious employment of the cellulose to which we owe so much

Removing Iodine Stains

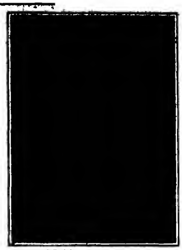
TO remove iodine stains from bacteriological instruments or the hands a strong solution of hyposulphite of soda is good and effective The solution should be quite strong, and after its application the solution should be rinsed off with warm water and the stained article dried well.

By courtesy of The Sphere

Fig 1.—Homo Mousteriensis.
Very primitive type from the older glacial drift at Le Moustier, France.

By courtesy of The Illustrated London News

Fig 2.—Jaws of chimpanzee, Australian native, and European.
Note the decreasing area of bony growth behind the front teeth, enlarging the mouth cavity for the development of speech Also the absence of chin in the first two specimens.



By courtesy of The Sphere

Fig 3.—Homo Aurignacensis.
From Aurignac, France Probably dates from the middle of the glacial epoch.

New Evidence of the Origin of Man

The Earliest Known Inhabitant of Great Britain

Of all the chapters of science perhaps none is so romantic as that which contains the fragmentary narrative of the dawn of human life upon our earth. The story is written with skull and cross-bone hieroglyphics, and no suspense that ever novelist contrived in his reader can equal that which the student of anthropology feels in the intervals between the successive instalments" of the serial unearthed, here a page and there a page, now in the silt of a river in France, now on the banks of a German stream, or again, it may be, on British soil

When, in the thirties of last century, Boucher de Perthes first claimed to have found flint implements shaped in glacial times by human hands, he was greeted with ridicule. Since then we have become quite accustomed to placing the origin of man at least as far back in time as the glacial epoch. But our knowledge of the early history of our race is based on all too scant data, and every new discovery of a jaw, a skull, or a more or less complete human skeleton, is received with intense interest. The latest addition to our knowledge of primitive man comes from Piltdown Common, Sussex England. Here, in the gravels once forming the bed of the River Ouse, but now many feet above its present level, an English paleontologist, Mr Dawson, discovered, about a year ago, a fairly complete human skull representing the most ancient relic of the human race in the British Isles, and one of the oldest found anywhere. The results of his studies of the specimen have recently been made public Properly to appreciate the fine points of this find it is necessary briefly to recall some of the characteristic features presented to us on the one hand in the highest type of human skull, as represented in modern civilized man, and on the other by the various inferior types known to us in primitive man living or extinct, and in our humbler relatives, the apes.

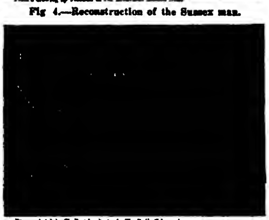
Considering first of all the jaw we have several interesting points brought out in our illustrations, Figs. 2 and 5. The former shows side by side the jaws of a chimpanzee, a Torres Straits Islander, and a European. Note how in the European the chin is seen projecting beyond the teeth, as seen from above. The chimpanzee and the Torres Straits Islander have no visible chin. This absence of chin, imparting to the face a snout-like appearance is typical of apes and low races of men, and is clearly indicated in our illustration of the newly found skull (Fig 6), though unfortunately the part of the jaw carrying the incisor and canine teeth is broken off and missing Another interesting feature should be noted In the chimpanzee the bone at the front of the jaw is quite wide, leaving a comparatively small open space in the angle of the jaw In the Australian native this space is larger, and in the European still more developed. When we remember the importance of the tongue in speech, this point acquires a marked significance

In profile view, as seen in Fig 5, several points of interest also appear The jaw of the ape and lower types of man is much more massive, and the notch in the upper end of the jaw—the sigmoid notch as it is called—is quite shallow in the ape, only slightly deeper in primitive, but is strongly developed in modern man.

As regards the brain case, the feature to which we naturally turn our attention first is capacity or cubical content. In this respect the newly discovered skull does not seem to stand as low in the scale as some specimens previously discovered elsewhere. A graphic comparison of the Sussex skull and the modern type is shown in Fig. 6. In this connection it is interesting to quote from Darwin

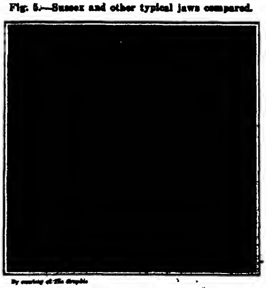
From a drawing by Forestier in The Illustrated London News

Fig 4.—Reconstruction of the Sussex man.



From a sketch by Sir Ray Lankester in The Daily Telegraph

Fig. 5.—Sussex and other typical jaws compared.



By courtesy of The Graphic

Fig. 6.—Skull of Sussex man compared with a highly developed modern type.

"Dr J Bernard Davis has proved, by many careful measurements, that the mean internal capacity of the skull in Europeans is 92.3 inches, in (native) Americans, 87 5, in Asiatics, 87 1, and in Australians, 81.9 inches. Prof Broca found that the nineteenth century skulls from graves in Paris were larger than those from the vaults of the twelfth century in the proportion of 1484 to 1426."

Another feature which gives a characteristic measure of the stage of development reached is the facial angle. This has been given as 62 degrees in the Neanderthal man, 57.5 degrees and 67 degrees for two fossil specimens found at Spy, and 56 degrees in the highest apes. Modern man has a facial angle of 80 to 85 degrees. It is the low facial angle, the absence of chin, the prognathous jaw, and the prominent orbital ridges over the eyes which give a characteristic and brutal appearance to primitive man, as pictured for us by Mr Forestier (Fig 4)

The brain capacity of the Piltdown skull is estimated at 1,070 cubic centimeters (65.3 cubic inches) It is interesting to compare with this the size of brain of some of the largest and most highly developed apes, the brain of the gorilla reaches a capacity of some 34 cubic inches. In this respect, therefore, the Piltdown skull might be said to stand about half way between the gorilla and modern man—neglecting the fact that the gorilla is more massive in body than man. Nevertheless, the Piltdown skull represents a considerably higher type, it seems, than the Neanderthal race, which has a much more slanting forehead. It appears, therefore, that at least one very low type of man with a comparatively high forehead was in existence in western Europe long before the low browed Neanderthal man became widely spread in this region. Dr Smith Woodward, who has been associated with Mr Dawson in his study of the Sussex skull, accordingly inclines to the theory that the Neanderthal race was a degenerate offshoot of early man and probably became extinct, while surviving modern man may have arisen directly from the primitive source of which the Piltdown skull provides the first discovered evidence.

One is naturally curious to know the age of the Sussex skull. The geologist is very cautious in estimating the age of fossils in years, but to make a very broad guess, it may be estimated that the Piltdown man lived some two or three hundred thousand years ago. Since that time the River Ouse has worn down its bed through a distance of eighty feet. The gravel bed in which the skull was found appears to belong to what the geologist terms the Lower Pleistocene age. The gravel consists largely of flints, among which many show signs of having been fashioned by human hands into rude implements. With the flints were discovered fragments of teeth of a Pliocene elephant and of a mastodon. Other remains were identified as belonging to a hippopotamus, a beaver, a horse, and part of the antler of a red deer

Such are the facts of the case. For those who like to give free rein to their imagination, there is ample scope for exercise in picturing the eventful life of primitive man, battling with wild beasts long since extinct, and, no doubt, engaging also in fierce combats with fellows of his own kind, for the frequent signs of violent injuries found in various fossil specimens attest eloquently to the strenuous struggle for existence that prehistoric man had to wage.

The Atoll Cloud

THE low-lying coral islands of the Pacific would be difficult objects for the mariner to sight at a distance, but for a curious meteorological phenomenon connected with them, to which attention has recently been directed by William Churchill. In his monograph on "Easter Island," just published by the Carnegie Institution, he says (page 50) "Even in the region of the lowest atolls a sailor's eye can read in the sky at enormous distances the loom of the land. The lagoon of Anaa reflects the sunlight which shimmers on its unruffled surface and casts so distinct a green hue upon the trade-wind clouds which it creates that its existence may be known as far upon the sea as if it were piercing the heavens a mile high instead of lying on the waves scarcely as elevated as the seas which shatter in tumult on its reef."

The characteristic green cloud formed over an atoll Mr Churchill has named elsewhere[1] the "atoll cloud." In a letter on the subject he gives further particulars

"I have picked up this island (Anaa) perhaps a score of times, and the same holds true in varying degrees of other of the Tuamotu atolls. I recall the same observation of Jaluit in the Marshalls, of Liueniua (Ongtong Java) off the Solomon Islands, and possibly of yet another great atoll in the same neighborhood. My attention was first directed upon the phenomenon by Polynesian sailors, but as soon as the eye has once caught the appearance of the cloud in the sky it is thereafter as unmistakable as the loom of the land itself. I may describe it as a characteristic pale green tint upon a thin white (fleecy cumulus) cloud, the tint being nacreous, but not quite so pronounced as the shade of the California abalone shell

"Anaa is a very typical instance. The lagoon is a still sea with much of its depth under two fathoms. The strand facing the lagoon is so flat that a ripple of no more than half a vertical inch will wet as much as fifty feet of sand. Water temperatures in the shallows have been noted between 35 and 37 deg. Cent. (95 to 98½ deg. Fahr.) I can find no record of sand temperatures on the beach, but you will see that they must run high, and, of course, they will prove a potent factor in evaporation when you recall what an acreage is dampened by the higher ripples and immediately exposed to evaporation under the hot sun Physically we have no difficulty in seeing what happens. We have a large still surface of shallow water with a maximum of evaporating surface upon almost level beaches, a hot sun acting thereon, a flat land without elevations to interrupt the upward movement of convection It may enter into the problem that this evaporating surface is surrounded by an ocean of cooler water Evaporate this big pan, and you have an upward current of air carrying aqueous vapor up to the region where it becomes saturated, and, therefore, visible as a superimposed cloud. The still lagoon also serves as a mirror of many miles' area reflecting from its light green surface the rays of the sun."

The same process of rapid evaporation and convection over an island sometimes gives rise to a cloud below the general level of the trade cumuli and differing from the latter in direction and velocity of drift. This phenomenon is described in a letter from Lawrence Hargrave, the Australian inventor of the box-kite.

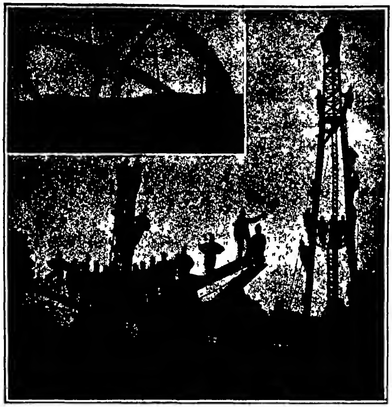
"Those who understand such things can often tell the position of an invisible reef or shoal by seeing a stationary cloud apparently ploughing its way through the ranks of the steadily moving trade clouds. If one be supposed to be above the clouds, this may be likened to a foam-flecked river passing a white stone projecting above the water. When there are no trade-wind clouds, a stationary cloud is still often an indication of reef, shoal, or island."

[1] Bull. Amer Geogr Soc., Oct., 1912, p. 754.

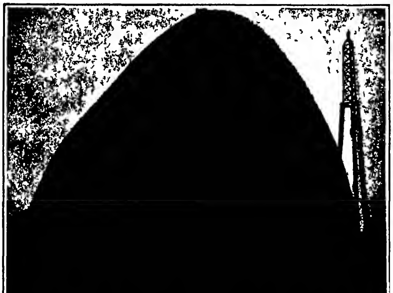
New Hangars for Military Uses

By Our Paris Correspondent

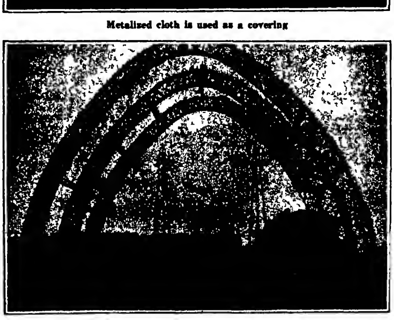
THE question of providing suitable hangars for air ships is receiving much attention in military circles in the leading countries of Europe, in order to keep pace with the development of airships for army use Such hangars may be divided into two general classes, one of these being a balloon shed of the fixed and permanent type which is erected once for all and belongs to certain military aeronautic establishments Up to the present it is the permanent hangar which has received the greater share of attention on the part of designers and constructors, but not less important is the type of movable shed which is also needed as part of the army material in order to give a suitable shelter for airships when carrying out military operations in various places where they may be at a considerable distance from any of the permanent posts. The question of a portable hangar is also the object of research on the part of constructors, and we illustrate one of the most recent ideas of the kind which has been brought out in Italy, this being the Bosco and Donadelli system, and it is worthy of note for several reasons. As several of our engravings show, it has been tried in field work by the aeronautic corps of the army



Arches in the course of erection. The pillars are built up of hinged sections.



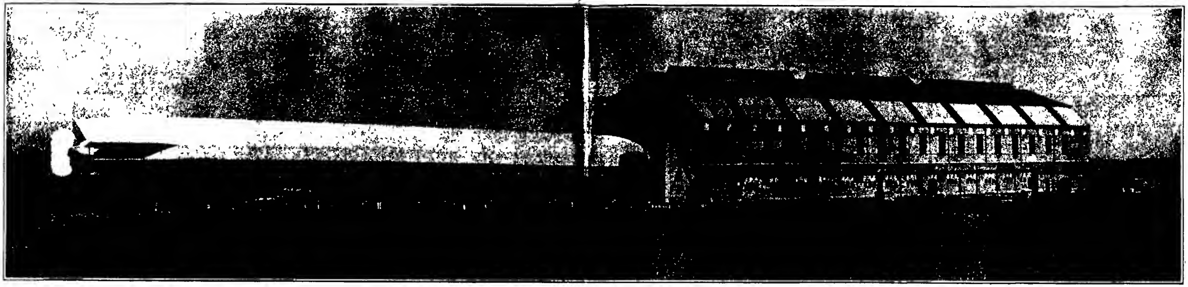
Metalized cloth is used as a covering



Each arch is built up in sections on the ground and is then raised into position.

The different sections which make up the arches are locked together by using a hinge clamp which is peculiar to the present system. Toothed projections on one piece fit into recesses on the opposite piece like the two halves of a hinge so that when placed together, all that is needed is to run a pin through the matched holes in order to couple the two pieces. Each arch is made up of a certain number of sections which are thus joined together, and there are two separate hinge joints used at the meeting point After locking one joint as we have seen, this forms a hinge so as to bring the other joint into place and it is then ready to be locked as before by means of a pin so that the two sections are tightly fixed together by means of the two joints. To dismount the sections, the only operation needed is to withdraw the two locking pins so that the joints readily come apart In this way the arch is built up while it is lying on the ground, and is then ready to be mounted in an upright position. At the proper points on the ground the base plates are laid which form the foot of the arch Each plate carries projecting lugs in the shape of a half hinge These are made to match with a like part on the arch end so as to make the joint After running a pin through the hinge while the arch is lying on the ground, the last is raised to the upright position by using ropes and pulleys, and when in place, the second joint between base-plate and arch now matches and this is fixed by driving in a pin, so that the arch is now fixed to the base-plate very strongly The second arch is now raised in the same way and the two are bound together by cross brace pieces of structural iron work as will be noticed, and so on until the right number of arches is erected

Another point in the assembling of the hangar needs to be considered, this being the erecting of the structural iron poles or towers which are required in order to draw up the arches by means of cables. It has been a problem to set up such towers in the proper way in field work, as they must have a considerable height in order to serve for handling the arches and at the same time must be very strong in view of the great weight of the arch The Italian constructors make use of the hinge joint principle in a very good way for mounting the towers. In the first place a short structural iron pole is fixed on the ground upon the base plate so as to form the lower and center part of the tower It carries a set of pulleys at the top for use in raising the rest of the tower in place The base plate is triangular, and at each end of the triangle a beam of the tower is fixed by means of a hinge joint This beam is in reality double, having a hinge placed at the middle upon its height, but both sections of the beam can lie on the ground owing to the hinges. All three beams come together at the outer or top ends and are hinged to a single top pole or cap. The whole can be assembled with the sections lying on the ground with the exception of the top cap, which fits down over the middle post When the hinge joints are



The "Zeppelin II" coming out of the great hangar at Cologne—one of the largest of its kind in existence.

assembled the whole is drawn to an upright position by ropes and pulleys and in this position the second joints between the various pieces all come together so as to be locked in place by pins thus making a three-sided tower with its capping and the whole construction is very solid.

In dismantling the tower the men climb to the top and draw out one of the hinge pins at each locking point leaving one joint which acts as a hinge as before. The tower is then lowered as a whole in the same way as it was raised. All these operations can be carried out in a short time. When the first two arches have been raised and bound together the tower is no longer essential for the arch structure can now take its place so as to carry the ropes for raising the other arches of the hangar.

A new fabric is used for the covering material comprising a metallized cloth which has great strength and is also weather proof. It hangs down at each end of the hangar as a double curtain which can be drawn apart at the sides. The dimensions of the new military hangar of the present standard type are 270 feet length by 100 width and 80 height. A very good speed in mounting is assured and all can be put together within two days. When transportation by railroad is necessary the metallic pieces with the covering and all needed parts are carried on a train of 21 cars.

An example of recent construction as regards the other class of hangars, that is the permanent balloon sheds, is shown in the type which has been erected at Cologne by the Augsburg-Nurnberg machine firm in order to house the Zeppelin airships. This hangar is noteworthy as being one of the largest of the military balloon sheds yet to be erected. One of the points which occupied the designer's attention was the operating of the huge double doors at the end of the hangar. In spite of the great size of these doors a suitable method of electric motor drive enables them to be opened in 4 or 5 minutes. The total length of the present hangar is very nearly 500 feet, its width 170, its height 92. The double doors are 82 feet high and each door is 34 feet wide.

Cost Estimates of Horse and Motor Trucks

By John Ritchie Jr

As noted in the SCIENTIFIC AMERICAN of June 22nd last a careful study of comparative costs of vehicles is being made at the Massachusetts Institute of Technology, under the supervision of Dr. Harold Pender and the direct management of research associate H. F. Thomson. The researches of the Institute during the past summer and fall have been in the nature of an inquiry into tire costs, repair costs and other expense matters and are reported in Vehicle Research Bulletin No. 2. Some notion of the amount of work involved in the research may be gained from the statement of Mr. Thomson that more than one hundred thousand observations have been taken upon the performance of wagons engaged in their daily work upon the streets and roads not only in Boston but in New York, Chicago, Philadelphia, Washington, St. Louis, and Detroit as well as in a number of smaller places within the same extent of country. There have been thousands of tapes from registering devices and other thousands of corroborative observations attesting the facilities of the Institute for collecting and digesting such scientific material.

Relations Between Annual Cost of Motor Trucks And Characteristics of Service

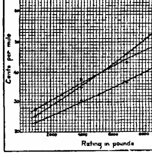
	Tires	Repairs	Battery Renewals	Lubricants	Electricity — Gasoline	Garage Expense	Painting	Driver and his pay	Amortization or Depreciation	Interest	Insurance	Administration and Taxes
(a) Character of work												
Size and type of truck	x	x	x	x	x	x	x	x	x	x	x	x
Nature of loads	x	x	x		x		x	x	x		x	
Number of stops	x	x	x	x	x	x	x		x			x
Distance per day	x	x	x	x	x				x			
Number of hours per day	x	x	x	x	x				x			
Days in service	x	x	x	x	x	x		x				
(b) Roads and climate												
Road surface	x	x	x		x				x			
Grades		x	x		x				x			
Other street traffic		x	x		x						x	
Climate	x		x	x	x		x					
(c) System of operating												
Routing		Indirectly as this item affects distance										
Loading and unloading		Indirectly as this item affects distance										
Overloading	x	x	x	x	x			x	x			
Overspeeding	x	x	x	x	x			x	x			
Garage facilities		x	x		x	x	x		x		x	x
Care of cars	x	x	x	x	x			x	x			x

Table showing by x's what service conditions affect the various expense items.

It is practically impossible to predetermine what will be the total annual cost of operating a truck at given rating, without knowing what will be the requirements of the service, the nature of the road and the general method of handling and repairing for the cars. To illustrate the difficulties involved in making up such an estimate the accompanying table has been prepared showing the relations between the various items of expense and the character of the work to be done, the nature of the roads and climate, and the system of operation.

In the expense for tire renewals the bulletin places the average mileage cost for the five ton electric at about 8 cents and for a five-ton gasoline about 9 cents, the corresponding data for the three ton car being 3½ cents and 4 cents. Several of the light gasoline cars which have been reported have been equipped with pneumatic tires, in which cases the mileage cost was as much as twice that for the solid tire equipment on the machines of the same size. Referring to the reports upon the apparent repair expense it is found that for the electric truck this expense is practically as great for the large cars as for the small ones. In the small sizes the reports in special cases show a cost considerably in excess of that commonly referred to by car manufacturers. With the gasoline machine the repair expense in the majority of cases where the car has undergone a thorough overhauling is far in excess of the manufacturer's figures, the average being from one and a half to two times as great. The reports for garage expenses are very irregular ranging all the way from $11 a year to $450 and averaging about $200 per year. The average consumption of electricity for electric trucks with lead batteries, ranges from about 500 watt hours per mile for the light delivery wagon to about 1,200 watt hours for the five-ton truck. The number of miles per gallon of gasoline varies from three to four miles for the four, five and seven ton machines to about nine miles for the light cars.

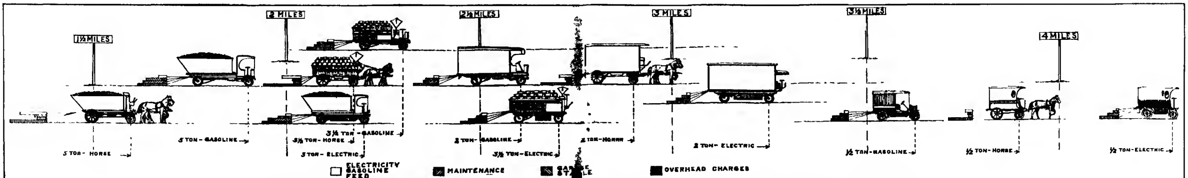
Four estimates have been made whose details are based upon the performance study (the full results of which study are not yet ready for publication) and upon the cost information presented in Vehicle Research Bulletin No. 2. The total comparative expenses per delivery as given in these estimates are plotted against the size of the truck in the accompanying chart. The respective curves for the horse, gasoline and electric wagon indicate that the power wagons have an increasing superiority over the horse wagon with an increase in size. The vehicles chosen for the estimate are of one thousand, four thousand, seven thousand and ten thousand pounds rated capacity respectively employed in parcel, furniture, draft beer and coal delivery. The territory covered in each case is assumed to be within four miles of the loading point. The expense items have been grouped under the head of (1) electricity, gasoline or feed, (2) maintenance including tires or shoeing, repairs, battery, veterinary, lubricants, (3) garage or stable, driver and helper, (4) overhead charges including depreciation, interest and insurance. The accompanying drawing is based on these estimates and shows the comparative distances that can be covered by the various types of vehicles at an expenditure of $1. Each vehicle is dragging behind it its load of expenses per mile, the separate bars of the load representing fuel, maintenance, garage or overhead charges as indicated by the legend. The cars have all started from a common starting point and before the half ton electric vehicle has run up one dollar's worth of expenses it has covered a distance of four and one third miles while for the same outlay of money the five ton horse drawn coal truck has covered but a mile and two thirds. The other vehicles are distributed between these limits as shown in the drawing. In these estimates the expense for electricity has been placed at 5 cents per kilowatt hour, that of gasoline at 15 cents per gallon and of feed at $100 per head per year. As shown in the chart the total expense per mile for the half ton electric vehicle is 23 cents. How this amount is divided up into the various items of expense is indicated by the length of the bars constituting the load that drags behind the vehicle. The same is true of all the other vehicles. The expense loads are all drawn to the same scale so that it is a simple matter to compare any vehicle with any other by measuring the relative lengths of the bars.



Estimates of total expense of 1 ton parcel, 2-ton furniture, 3½-ton keg-beer and 5-ton coal trucks.

Testing Eggs by Roentgen Rays

A LARGE association of English poultrymen which delivers 200,000 eggs per week to London merchants has for some time made successful commercial use, according to *La Technique Moderne*, of the Roentgen ray apparatus for testing the freshness of eggs. The lamp is inclosed in a box impervious to light except on one side in whose wall an opening proper for the reception of the egg is made. An absolutely fresh egg when placed therein appears perfectly transparent. Eggs which are older, even if still edible, show small spots. These are not visible to the naked eye in ordinary light but are shown on the fluorescent screen of the apparatus quite clearly. When such spots exceed a certain size the egg is declared unfit for food. These examined eggs, which are certified by a stamp, are already much sought after in the London market.



The trucks have run as far as they can on one dollar. The distances they have covered may be judged from the mile-posts. Dragging behind the vehicles are bars indicating the expenses charged per mile against each truck.

A dollar race, based on estimates compiled by the Massachusetts Institute of Technology for short distance truck service.

What Motor Truck Would Suit Me Best?

A Composite List of American Motor Trucks and Delivery Wagons Arranged According to Carrying Capacity

Compiled by Theodore M. R. von Kéler

To arrange commercial motor vehicles according to price is almost impossible, as the great majority of both heavy and light cars are furnished with bodies suited to the special needs of the purchaser. This list, therefore, has been based upon the carrying capacity, and the prices in most instances apply to the chassis, fitted with driver's seat. Bodies in a great variety of forms are furnished by the manufacturers at prices ranging from $100 upward.

The majority of truck manufacturers are willing to sell to small merchants on easy payments, and to supervise the installation of motor service by means of their own service departments.

As in the list of pleasure cars published last week, the many small companies of purely local importance have been omitted, and only the leading models have been listed. Besides the factories named herein there are nearly one hundred companies which have been formed within the last six months, and whose prospective output will not fall short of 5,000 trucks during the coming year. As yet their product has not reached a stage which would warrant its listing in a national periodical.

Capacity 500 to 1,000 Pounds.

Anderson Elec Car Co., Detroit Mich ($2,845)
Bessemer Motor Truck Co, Grove City, Pa. ($1,250)
Bowling Green Motor Car Co. Bowling Green, O ($1 200)
Chase Motor Truck Co Syracuse, N Y ($500)
Commerce Motor Car Co., Detroit, Mich ($750)
Dart Mfg Co, Waterloo, Iowa. ($750)
Durant Dort Carriage Co., Flint, Mich. ($750)
General Vehicle Co. Long Island City, N. Y ($1 370)
Hupp Motor Car Co., Detroit, Mich ($950)
Ideal Auto Co. Fort Wayne Ind ($1 500)
McIntyre W H Co., Auburn Ind. ($600)
Mercury Mfg Co., Chicago, Ill. ($750–$900)
Moon J W Buggy Co. St. Louis, Mo ($1 150)
Studebaker Corp., South Bend, Ind ($1 500)
Sullivan Motor Car Co. Rochester, N Y ($925)
U S. Motor Co. Detroit, Mich ($1 400)
Ward Motor Vehicle Co., New York city ($1,200)
Waverly Co., Indianapolis, Ind ($1,800)

Capacity from 1,001 to 2,000 Pounds.

Adams Bros. Co. Findlay Ohio ($2,100)
Alden-Sampson Mfg. Co. Detroit, Mich ($2 000)
Anderson Elec Car Co, Detroit Mich ($2,870)
Atterbury Motor Car Co, Buffalo, N Y ($1 500)
Available Truck Co. Chicago, Ill. ($900–$1 350)
Avery Co Peoria, Ill ($2 000)
Bessemer Motor Truck Co. Grove City, Pa. ($1 800)
Bowling Green Motor Car Co., Bowling Green O ($1 600)
Brown Commercial Car Co Peru, Ind. ($1 650)
Buick Motor Co. Flint Mich ($1 000–$1 400)
Chase Motor Truck Co. Syracuse N Y ($1 250)
Chicago Pneumatic Tool Co, Chicago, Ill ($1 050)
Croce Auto Co Asbury Park, N J ($1 850)
Dart Mfg Co Waterloo Iowa ($1 100)
Durant Dort Carriage Co. Flint Mich ($1 375)
General Vehicle Co Long Island City N Y ($1,710)
Gramm Motor Truck Co, Lima, O ($1 750)
Harwood Barley Mfg Co. Marion Ind.
Hexter Motor Truck Co., Lima, O ($1 750)
Hupp Motor Car Co., Detroit, Mich ($750)
Ideal Auto Co Fort Wayne, Ind ($1 750–$2,000)
International Motor Co., New York city ($2 500)
Kelly Springfield Motor Truck Co., Springfield O ($2,000)
Kissell Motor Car Co., Hartford, Wis. ($1 500)
Knickerbocker Motor Truck Mfg. Co., New York city ($2,000)
Koehler H J Co New York city ($750)
Krebs Commercial Car Co., Clyde, O ($1,375)
Lauth Juergens Motor Car Co., Fremont, Ohio. ($2 100)
Lippard Stewart Motor Car Co., Buffalo, N Y ($1 050–$1 675)
McIntyre W H Co Auburn, Ind ($1 500)
National Motor Truck Co Bay City Mich ($1 225)
Nyberg Automobile Works, Anderson Ind ($1 300)
Oakland Motor Car Co Detroit Mich ($1 500)
Piggins Motor Truck Co Racine Wis. ($1 750)
Pope Mfg Co Hartford Conn ($1,750)
Poyer D F Co Menominee, Ind. ($1 200–$1 500)
Reo Motor Truck Co Lansing Mich ($750)
Rowe Motor Mfg Co Coatesville Pa ($1 700–$2 100)
Sandusky Motor Truck Co Sandusky, Ohio. ($1 400)
Sanford Motor Truck Co Syracuse N Y ($1 080)
Selden Truck Sales Co Rochester N Y ($2 000)
Service Motor Car Co. Wabash Ind ($1 350–$1 475)
Stewart Motor Corp. Buffalo, N Y ($1 650)
Studebaker Corp., South Bend, Ind ($2,000)
Sullivan Motor Car Co Rochester, N Y ($1,050)
Transit Motor Truck Co., Louisville, Ky ($1,850)
Universal Motor Truck Co., Milwaukee, Wis. ($1,950)
Velie Motor Vehicle Co., Moline, Ill. ($2 000)
Ward Motor Vehicle Co., New York city ($2 000)
Waverly Co Indianapolis, Ind. ($2,150)
White Co., Cleveland O ($2,100)
Wilcox Motor Car Co., Minneapolis, Minn $2,300)

Capacity from 2,001 to 3,000 Pounds.

Adams Bros. Co. Findlay Ohio ($2,300)
Alden Sampson Mfg. Co., Detroit, Mich ($2,500)
Anderson Electric Car Co., Detroit. Mich. ($3,132.50)
Atterbury Motor Car Co., Buffalo, N Y ($2 400)
Auto Car Co., Ardmore, Pa. ($2,150)
Bessemer Motor Truck Co., Grove City, Pa. ($2,100)
Blair Mfg Co Newark, O ($3,000)
Bowling Green Motor Co., Bowling Green, O ($1 850)
Chase Motor Truck Co., Syracuse, N Y ($1,750)
Croce Auto Co Asbury Park, N J ($2,500)
Dart Mfg Co Waterloo, Iowa. ($1,800)
Federal Motor Truck Co., Detroit, Mich ($1,800)
Four Wheel Drive Co, Clintonville, Wis. ($3 000)
General Motors Co Detroit, Mich. ($2,075)
Grand Rapids Motor Truck Co, Grand Rapids, Mich ($2,200–$2,500)
Harwood Barley Mfg. Co., Marion, Ind. ($2 000)
Ideal Auto Co. Fort Wayne, Ind. ($2 250)
International Motor Co., New York city ($2 750)
Juno Motor Truck Co. Juneau Wis. ($2,200)
Knickerbocker Motor Truck Mfg. Co, New York city ($2,250)
Krebs Commercial Car Co., Clyde O ($1 775)
Mais Motor Truck Co., Indianapolis, Ind ($2 750–$2,800)
McIntyre W H Co, Auburn, Ind ($2,300)
Moon J W Buggy Co., St. Louis, Mo. ($1 900)
Piggins Motor Truck Co., Racine Wis. ($2,250)
Reo Motor Truck Co., Lansing, Mich ($1,800)
Rowe Motor Mfg Co, Coatesville Pa. ($2,850)
Sanford Motor Truck Co., Syracuse, N Y ($1 910)
Service Motor Co, Wabash Ind ($1,675)
Studebaker Corp, South Bend Ind ($2,050)
Transit Motor Truck Co., Louisville, Ky ($2 300)
Universal Motor Truck Co, Milwaukee Wis. ($2,750)
U S. Motor Co. Detroit, Mich ($2,200)
Welter Motor Truck Co, New York city ($2,800)
White Co., Cleveland, O $3,000
Wilcox Motor Car Co., Minneapolis, Minn. ($2,500)

Capacity from 3,001 to 4,000 Pounds.

Adams Bros. Co., Findlay Ohio. ($2,500)
Alden Sampson Mfg Co., Detroit Mich ($2,800)
American Locomotive Co., Schenectady, N Y ($2,950)
Atterbury Motor Car Co. Buffalo, N Y ($2 650)
Avery Co. Peoria, Ill. ($3,700)
Chase Motor Truck Co., Syracuse, N Y ($2,200)
Croce Auto Co., Asbury Park, N. J ($2,850)
Garford Co. Elyria, O ($2,900)
General Motors Co., Detroit, Mich ($2,750)
General Vehicle Co., Long Island City, N Y ($2,090)
Gramm Bernstein Co., Lima, O ($3,750)
Gramm Motor Truck Co., Lima, O ($2,600)
Harwood Barley Mfg Co., Marion, Ind ($2 500)
Hexter Motor Truck Co., Lima, O ($2,600)
Ideal Auto Company Ft. Wayne, Ind. ($3,500)
International Motor Co., New York city, N. Y ($3,000)
Juno Motor Truck Co., Juneau, Wis. ($2,800)
Kissell Motor Car Co. Hartford Wis. ($2,750)
Knox Auto. Co. Springfield, Mass. ($3,000)
Lauth Juergens Motor Car Co, Fremont, O. ($2,800)
Mais Motor Truck Company, Indianapolis, Ind. ($2,950–$3,000)
Mogul Motor Truck Co., Chicago, Ill. ($2,750)
Packard Motor Car Co., Detroit, Mich. ($2,800)
Packers Motor Truck Co., Wheeling, W Va. ($2,675)
Piggins Motor Truck Co., Racine, Wis. ($2,750)
Reo Motor Truck Co., Lansing, Mich. ($1,980)
Rowe Motor Mfg. Co., Coatesville, Pa. ($3,100)
Smith, A. O, Co. Milwaukee, Wis. ($3,000)
Speedwell Motor Car Co., Dayton, O ($2,850)
Sternberg Motor Truck Co., Milwaukee, Wis. ($2,800)
Studebaker Corp., South Bend, Ind. ($2,800)
Suburban Truck Co., 1420 Chestnut St., Philadelphia, Pa. ($2,750)
Transit Motor Truck Co., Louisville, Ky ($2,850)
Universal Motor Truck Co., Milwaukee, Wis. ($2 750)
Velie Motor Vehicle Co., Moline, Ill. ($2,850)
Walter Motor Truck Co., New York city ($3,000)
Ward Motor Vehicle Co., New York city ($2,900)
Waverly Co., Indianapolis, Ind. ($2,000)

Capacity from 4,001 to 6,000 Pounds.

Alden Sampson Motor Car Co., Detroit, Mich ($3,400)
Atterbury Motor Car Co., Buffalo, N Y ($3,350)
Avery Co., Peoria, Ill. ($3,200)
Blair Mfg. Co., Newark, O ($3,250)
Couple-Gear Freight Wheel Co., Grand Rapids, Mich. ($3,500)
Croce Auto Company, Asbury Park, N J ($3,600)
Federal Motor Truck Co., Detroit, Mich. ($2,800)
Four-Wheel Drive Co., Clintonville, Wis ($4 000)
Garford Co Elyria, O ($3,500)
Gramm Motor Truck Co., Lima, O ($2,500)
Harwood Barley Mfg. Co., Marion, Ind ($3,200)
Hexter Motor Truck Co., Lima, O. ($3,500)
International Motor Co., New York city, ($3,750)
Juno Motor Truck Co., Juneau, Wis. ($2,400)
Kelly Springfield Motor Truck Co., Springfield, O ($3,400)
Kissel Motor Car Co., Hartford Wis. ($2,850)
Knickerbocker Motor Truck Mfg. Co., New York city ($3,500)
Knox Automobile Co., Springfield, Mass. ($3,700)
Lauth-Juergens Motor Car Co., Fremont, O. ($3,450)
Mais Motor Truck Co., Indianapolis, Ind. ($3,400)
McIntyre W H Co., Auburn, Ind ($3,200)
Packard Motor Car Co. Detroit, Mich. ($3,400)
Peerless Motor Car Co., Cleveland, O ($3,700)
Piggins Motor Truck Co., Racine, Wis. ($3,000)
Rowe Motor Mfg Co. Coatesville, Pa. ($3,400)
Standard Motor Truck Co., Detroit, Mich. ($2,750)
Service Motor Car Co., Wabash, Ind. ($2,475)
Sternberg Motor Truck Co., Milwaukee, Wis. ($3,400)
Universal Motor Truck Co., Milwaukee, Wis. ($3,400–$3,500)
U S. Motor Co. Detroit, Mich ($3,400)
Velie Motor Vehicle Co. Moline, Ill ($3,350)
Victor Motor Truck Co., Buffalo, N Y ($2,750)
Walter Motor Truck Co., New York city ($3,400)
White Co, Cleveland, O. ($3,700)
Wilcox Motor Car Co., Minneapolis, Minn. ($3,250)
Wyckoff, Church & Partridge, New York city ($4,750)

Capacity from 6,001 to 8,000 Pounds.

Alden Sampson Motor Car Co., Detroit, Mich. ($4,250)
American Locomotive Co., Schenectady, N Y $3,650)
Anderson Elec. Car Co., Detroit, Mich. ($5,000)
Blair Mfg. Co., Newark, O. ($3,750)
Couple-Gear Freight Wheel Co., Grand Rapids, Mich. ($4,400)
Garford Co., Elyria, O. ($3,850)
General Motors Co., Detroit, Mich. ($3,500–$3,750)
General Vehicle Co., Long Island City, N. Y ($3,650)
Gramm-Bernstein Co., Lima, Ohio. ($3,600)
International Motor Co., N Y city ($4,250)
Kissel Motor Car Co., Hartford Wis. ($3,650)
Knickerbocker Motor Truck Mfg. Co. ($4,000)
Mogul Motor Truck Co., Chicago, Ill. ($3,300)
Packers Motor Truck Co., Wheeling, W Va. ($3,500)
Peerless Motor Car Co., Cleveland, O. ($4,000)
Smith, A O., Co., Milwaukee, Wis. ($3,750)
Speedwell Motor Car Co., Dayton, O ($3,750)
Sternberg Motor Truck Co., Milwaukee, Wis. ($4,000)
Studebaker Corp., South Bend, Ind. ($3,500)
Transit Motor Truck Co., Louisville, Ky ($3,500–$3,750)
Welter Motor Truck Co., N. Y city ($3,750)
Ward Motor Vehicle Co., New York city ($3,400)
Waverly Co., Indianapolis, Ind. ($3,500)
Wyckoff, Church & Partridge, New York city ($5,250)

Capacity from 8,001 to 10,000 Pounds.

Aires Motor Truck Co., N Y city ($5,250)
Alden-Sampson Motor Car Co., Detroit, Mich. ($4,750)
American Locomotive Co., Schenectady, N Y ($4 750)
Atterbury Motor Car Co., Buffalo, N Y ($4,250)
Avery Co., Peoria, Ill. ($4,500)
Couple-Gear Freight Wheel Co., Grand Rapids, Mich. ($5,000)
Croce Auto Co., Asbury Park, N J ($4,500)
Garford Co., Elyria, O. ($4,500)
General Motors Co., Pontiac Mich. ($4,400)
General Vehicle Co., Long Island City, N Y ($3 950)
Gramm Motor Truck Co., Lima, O ($4,500)
Hexter Motor Truck Co., Lima, O ($4,500)
International Motor Co., New York city, N Y ($4 800–$5,000)
Kissel Motor Car Co., Hartford, Wis. ($4,250)
Knickerbocker Motor Truck Mfg. Co., New York city ($4,500)
Lauth-Juergens Motor Car Co., Fremont, O ($4,500)
Locomobile Co. of America Bridgeport, Conn ($4,800)
McIntyre, W H, Co., Auburn Ind. ($4 200)
Packard Motor Car Co., Detroit, Mich ($4,500)
Peerless Motor Car Co. Cleveland, O ($4 500)
Pierce-Arrow Motor Car Co., Buffalo, N Y ($4,500)
Piggins Motor Truck Co., Racine, Wis. ($3,800)
Rowe Motor Mfg. Co., Coatesville, Pa ($4,500)
Sternberg Motor Truck Co., Milwaukee, Wis ($4 500)
Studebaker Corp. South Bend, Ind. ($4,250)
Transit Motor Car Co. Louisville, Ky ($4,500)
U S. Motor Co Detroit, Mich ($4,750)
Victor Motor Truck Co., Buffalo, N Y ($3,650)
Welter Motor Truck Co., N Y city ($4,500)
Waverly Co., Indianapolis, Ind. ($4,000)
White Co., Cleveland, O ($4,500)
Wyckoff, Church & Partridge, New York city ($5,750)

Capacity from 10,001 to 14,000 Pounds.

Aires Motor Truck Co., N Y city ($6,000)
American Locomotive Co., Schenectady, N Y ($5,200)
Couple-Gear Freight Wheel Co., Grand Rapids, Mich. ($5,600)
Garford Co., Elyria, O ($4,850)
General Motors Co., Detroit, Mich ($4,400)
Hexter Motor Truck Co., Lima, O. ($4,750)
Hydraulic Truck Sales Co., N Y city ($5,500)
International Motor Co., New York city ($5,200–$6,000)
Mogul Motor Truck Co., Chicago, Ill. ($4,400)
Smith, A. O., Co., Milwaukee, Wis. ($4,750)
Speedwell Motor Car Co., Dayton, O. ($4,400)
Transit Motor Truck Co., Louisville, Ky ($4 500)
Victor Motor Truck Co., Buffalo, N. Y ($3,650)
Walter Motor Truck Co., N. Y city ($5,000)
Wyckoff, Church & Partridge, New York city, ($6,250)

Capacity Over 14,000 Pounds.

Couple-Gear Freight Wheel Co., Grand Rapids, Mich. ($6,200–$6,250)
International Motor Co., New York city, ($5,200–5,800)
Studebaker Corp., South Bend, Ind. ($4,[illegible])

Notes and Queries.

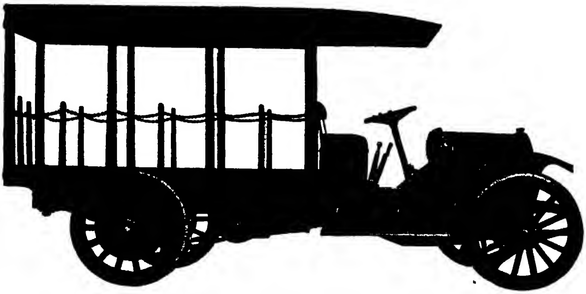
Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12726) F W M asks An upright, tight, heating drum, 5 feet high, 8 inches diameter having 3¼-inch top connection (no damper) to chimney and inside, on bottom of drum a ring burner of 1-inch pipe for gas, with Bunsen air mixer taking air from outside, and also a 2-inch bottom connection to take in fresh air into drum. The gas will not burn in the ring burner inside of drum It blows out. Why? A If your Bunsen burner has a greenish color at the bottom of the flame and vibrates and snaps out, there is not sufficient air furnished by the mixer There should be an adjustment to control the amount of air admitted to the gas, so that the burner will burn quietly and with a flame almost colorless when seen in a lighted room.

(12727) J W asks I would very much like to know if there is any truth in a certain French chemist, who states that he has made the diamond in the rough Some time ago I read in an editorial (have forgotten whether it was in your paper or some other paper) of its being done, and told it to a friend who claims it cannot be done I would be very much obliged if you would let me know about it A. You are not misinformed that diamonds have been made artificially The process is described in SUPPLEMENTS 1551 1552 1553 price ten cents each, in a lecture by no less an authority than Prof William Crookes. These stones are very small, however the largest being about three thousandths of an inch across They are conceded to be real diamonds, and if small ones can now be made, perhaps some time large ones may be made. The 'certain French chemist is none other than the famous Moissan the man who has almost created the use of the electric furnace. We should say there is truth in any claim he may make.

(12728) P M asks 1 Why the sun appears to set at an earlier hour say about December 16th than it sets December 21st or 22nd the winter solstice A The sun sets just as long *after* noon as it rises *before* noon all the time, every day in the year The clock however does not stand at 12 at noon on any day of the year, with the exception of four days, about April 15th, June 14th September 1st and December 24th but the dates vary a little from year to year partly because of the extra day inserted in leap years. The subject is too extensive for discussion in a letter and is explained in all the text-books of astronomy under the caption Equation of Time You can doubtless in your city library find Todd's "New Astronomy or Young's Manual of Astronomy either of which will cover the subject. 2 Why is it that at certain seasons the sun rises later every day but, at the same time sets at the same hour and minute, over a period of say 8 or 10 days? A. Your second question is answered by saying that sunrise and sunset are calculated and given in the almanacs for the real sun but the clocks do not keep the time of the real sun since the apparent motion of the real sun is not uniform day by day Hence the apparent difficulty which is explained in Todd on page 113 under the heading Retardation of Sunset near the Winter Solstice.' Should you wish to own either or both of these valuable books, we can furnish Todd's "New Astronomy' for $1 45 and Young's Manual for $2.50 and shall be pleased to receive your order We thank you for your expression of appreciation of our astronomical articles.

(12729) F M asks How are trees splintered by lightning? Not long ago I examined the result of lightning on a large tree. Some large limbs that lay on the ground showed that each small twig and limb had a hole bored its length just under the bark. I could not find any entrance or exit holes, but cutting showed this one hole in the section, and charring was not in evidence. I took several of the sticks home, but cannot find them now When the current gathered at the trunk it was too much for the carrying capacity and splintered the wood in seeking an onward path and the limbs fell. Was not the tree's conductivity the sole cause for the effects? Had the tree been dead and dry, it would have been splintered much worse. Lightning follows the fiber whether the tree is dead or alive, straight in the limbs and more or less spirally in the trunks. The great Maxwell believed heat, light, and electricity to be the same i. e vibratory Why could not the vibrations of electricity crowd themselves on a poor conductor sufficient to tear it apart? A We thank you for your observations upon the action of an electric discharge upon the wood of a tree. All non-conductors are ruptured by the dissipation of a heavy charge of electricity upon or through them. The trees and wood generally form no exception to this general effect. Conductors are not thus affected, since they allow the dissipation to take place without resistance on their part The better a non-conductor, that is, the poorer a conductor a material is, the more is it rent into pieces by an electric shock. Light, heat, and electricity are regarded by scientists as manifestations of one energy, differing principally in wave length. All these are electro-magnetic effects. Lightning only differs by the magnitude of its display.



The 3/4 Ton Utility Truck—$1250

(*Chassis Only*)

THIS new Utility truck is the most practical and serviceable truck of its size ever built. It is intended for any kind of city and suburban delivery service. It works more simply, more economically, more rapidly and more effectively than most trucks of much larger size. It is a new development.

Unlike the average small truck, it is *not* a built-over or a redesigned pleasure chassis. It is a real heavy truck in all of its parts, in its entire design, in its whole construction and in its economical operation. For instance, the powerful 4-cylinder motor is controlled by our patented governor; it cannot be driven over 18 miles an hour; it has quick demountable solid tires 36" x 3" front and 36" x 3½" rear; it has an unusually rugged pressed steel frame, doubly reinforced at points where it will receive the greatest strains; the wheel-base is 120 inches.

Throughout this truck is built on the most modern truck lines. It is made in one of the largest truck plants in the world by men who have been building successful trucks for over ten years It is built by truck specialists.

For the merchant or manufacturer who has a whole lot of daily deliveries to be taken care of, this new Utility truck is well worth immediate investigation.

See the nearest Gramm dealer, or write us and we will send you one of our transportation experts.

Literature and transportation advice from the factory—gratis.

See this new truck at the Chicago Truck Show

Section D, Coliseum

The Gramm Motor Truck Company, Lima, Ohio

John N. Willys, President

BRIEF SPECIFICATIONS

CARRYING CAPACITY—1500 lbs. Maximum, 2000 lbs.

BODY—Optional and extra.

FRONT AXLE—[illegible] Section. Timken bearings.

REAR AXLE—[illegible] Section, [illegible] bearings [illegible].

MOTOR—4 cylinders, 4 in. bore—4½ in. stroke. Provided with enclosed and sealed governor

TRANSMISSION—Selective type. Three speeds forward and one reverse.

WIDTH OF FRAME—34 inches

WHEEL BASE—120 inches.

TIRES—Front, 36x3, Rear, 36x3½ Goodyear Solid

LOADING SPACE — Approximately, 48 inches x 96 inches.

GASOLINE CAPACITY — 20 Gallons.

EQUIPMENT — Two side oil lamps Oil tail lamp, horn, and full set of tools.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons The Editor will endeavor to answer any questions relating to mechanical features operation and management of commercial motor vehicles

Business Getters for Small Concerns

By Charles H Spencer

BEFORE the experiment was made the small user considered the motor truck out of his reach When the motor truck salesman called the usual response was, Let the big fellow do it. We can t. They have to do things on a big scale. Their plants are large They can afford to get fleets of cars to hire skilled and expensive men to take care of them to buy gasoline at reduced rates and to profit all along the line by purchasing in volumes reaping the benefit of cost reduction by so doing There seems to be plausibility and business discretion in this argument until analysed Then it will be found that like nearly every proposition which is opposed to progress it is based on unsound reasoning, The business man who resigns himself to a small volume of business and is not concerned in installing facilities for handling an increase is never likely to get the increase

Customers Beyond the Horse s Reach

The city merchant not equipped with the commercial vehicle is now finding himself compelled either to abandon the efforts to secure the business in the suburban trade or to expend a sum of money on horses and suitable wagons that consume his profit and make his venture unprofitable The man using horses has to limit himself to the area in which the animal has to deliver Farther than this the country is closed to him There may be thousands of customers beyond the boundary line of the horse s power It is generally agreed that a ten mile radius is about the limit in which it is possible to use a horse-drawn delivery system By the time a horse has hauled a load for ten miles made many stops and completed the ten mile journey back it has done about all the work possible for him When any more than twenty miles daily is piled on the animal it is done at a risk it means perhaps the collapse of the horse a dead loss to the owner and permanent impairment of his delivery system

The electric vehicle ideally adapted to quick delivery within the city limits or to suburban points is good for a radius of from twenty to twenty five miles a day going and coming and finally a gasoline propelled motor truck is in many instances delivering at distances of fifty miles from its starting point which means that it covers a delivery route of one hundred miles a day

A Wholesale Grocer's Experience

A short time ago the writer s attention was called to a wholesale grocer who decided he did not have enough customers to support the overhead expenses of his store He decided to create a small field of action and for this reason he picked out a truck He was prepared to have it cost him a little more money just as he believed in spending additional money for advertising or increasing the salary of a productive salesman The results he obtained were very prompt in forthcoming His truck went where his wagon never before could reach and he found that there was business waiting in sections he little dreamed of. He put on more salesmen who in this way were given the advantage of being able to promise prompter deliveries than they had been able to maintain before The increase was so rapid, and the profit so big that this particular grocer was obliged to put a new truck into service to care for the gain.

We know of a similar instance with a small retail ice concern that was competing with a large concern using horse-drawn vehicles. In less than a year's time after introducing a commercial truck, he was obliged to purchase an extra car and is now making wonderful increases in his business, and inroads into the trade of his competitor through his ability to serve his patrons more promptly

Another instance is of a retail grocer who found that a 1½ ton commercial vehicle displaced four horses and two wagons. This concern averages sixty miles per day now by the use of the motor truck and has extended the business territory of the company to a surprising degree New customers have been made and held by the promptness of delivery assured and the residences situated in unfrequented sections are reached where these were formerly a problem of great difficulty being visited weekly where now the motor truck calls daily

Making Chauffeurs Out of Drivers.

Many business men are deterred from buying motor trucks for fear their wagon drivers cannot learn to be chauffeurs There is no more intelligence required to operate and take care of a car than to take proper care of a horse There are a few motor truck manufacturers who conduct special schools for drivers at their different service buildings located in the various large cities of the country and it is their experience that the average teamster can be readily educated to operate a car One concern turned out last year over fourteen hundred students in one of these schools who were formerly drivers and reliable delivery men used in the days of the horse-drawn vehicle

The Right Car for the Purpose.

It has been found in many instances that a merchant has paid too little for his motor truck or has purchased a car too light in construction to withstand the daily delivery grind or too large for the particular handling of his merchandise There are over two hundred and sixty firms engaged in the manufacture of motor trucks in this country and it requires little effort to secure practically all the needed information regarding the particular type of truck that is meeting with success in the line of business in which the merchant is interested On looking carefully into the subject it is usually to be found that the best car for a particular line of business is the type that is already represented in greatest numbers in that line

Steel Tires in France

To the Editor of the Motor Truck Department

In the article on Subsidized Motor Trucks appearing in your issue of Sept 28th 1912 a statement was made which was very misleading for the reason that it was incomplete It referred to the French government test, and the assertion was made that "not one of the trucks shod all around with steel was able to qualify The author evidently did not know that this applied only to trucks of three tons capacity and less, in other words light trucks intended to be driven at speeds of about twenty miles per hour Thomas S Fay former president of the American Society of Automobile Engineers, who carefully investigated the French army test of steel tire trucks, said "Not a few makers of automobiles maintained that pneumatic tires would be even cheaper and better in the long run than solid rubber tires, thus suggesting strongly that steel tires were out of the question. But the French army had its way and their decision has had a marked influence on commercial transportation in France. To-day practically all French trucks over three tons capacity are fitted with [illegible]

of steel tires for the motors used by the armies of Germany, Austria, Russia and Japan, and steel-tired trucks are now being introduced into this country. To adapt a motor truck for steel tires, particular attention must be paid to the spring suspension of the chassis. The springs must be unusually long and flat so that they will have a maximum of resiliency. They must also be hung in such a way as to permit of side sway. The wheels must have very thick felloes, and hubs of wood with many substantial spokes. Motor trucks thus constructed may safely be driven at speeds up to ten miles or even fifteen miles per hour.

J. Jaccard & Co.

Abuse of Good Roads

By Arthur C. Brady

MUCH is written and a great deal of gossip is current regarding the abuse inflicted on good roads by the automobile.

The writer has made several personal examinations of new roads that have been opened and finds that the trouble charged to the automobile in this respect is very much exaggerated. The evidence seems to point to the fact that it is a combination of horse and automobile which interferes with road conditions.

In a recent walk of five miles over a new State road, opened only about a year ago between Millbrook and Poughkeepsie, the evidence was conclusive throughout the entire distance that it was the sharp calks of the horse-shoes that started the deterioration. This road had been covered with some oil substance which had made a very compact smooth surface and which was capable of shedding water. This surface was not broken or damaged in any way by the automobile service traveling over it, although a speed of 50 miles an hour is not unusual on this road. The print of every horse-shoe was distinct, however, and the calk cut through this cover, making an opening where the water finds its way through, thus giving a hold for the automobile tire to pick up small particles of dust and start an opening which soon grew to a size requiring attention.

It is always easier to point out the difficulty than find the remedy. Unless horses can be driven over State roads with rubber shoes, they are a great detriment to the wearing qualities, and in view of the fact that we are spending millions of dollars every year for good roads, I think it is worth consideration to look the matter straight in the face, and either arrange to build roads that will stand both horse and automobile wear, or equip horses used for road work with shoes that will not penetrate to a depth of ¼ inch as the calks do where newly shod horses are traveling at a fast gait.

Motor Truck Queries and Answers

J. P. B. asks: Will the next few years bring many changes in the design and construction of commercial motor vehicles?

A. This is a question frequently asked by prospective users, and their failure to secure a convincing answer is probably delaying many from purchasing motor vehicles. Practically every motor truck engineer will assert that the changes will be limited principally to minor refinements and improvements, which will make the vehicles of to-morrow but little better than those of to-day. Irrespective, however, of what the future may hold in store, the motor truck of to-day is a highly developed and very practical transportation unit, and no unjustified fears of radical changes in the future should influence those debating its adoption.

A. L. P. asks: Is there any advantage in the motor truck with the motor in front under a hood, as in pleasure cars, over the truck with the motor under the seat?

A. With the motor under the driver's seat it is possible to have a shorter wheel base and over-all length. Where a very long body is used or where many turns have to be made in narrow streets this is naturally an advantage. On the other hand, there are a number of advantages

claimed for the motor in front under a bonnet This construction brings more of the load weight on the rear axle, where it properly belongs and can be readily cared for enabling the use of lighter spring suspension in front, where the power and driving mechanism is located, both of which need to be relieved of jar as much as possible. It provides easier handling of the vehicle and a more accessible power plant. In its new specifications pertaining to motor trucks eligible for subsidy the British War Department bars all vehicles not having motors in front.

IN the SCIENTIFIC AMERICAN of October 26th 1912 was an article by Mr Morris A Hall on the delivery service of New York's department stores in which it was stated that the saving of the trucks over horses was found by Stern Brothers to be $1 012 a year for each motor driven unit The figure should have been $2 112

Moving and Talking Pictures

(Concluded from page 65)

the film after exposure The Court of Appeals for the Second Circuit (see 151 F R 107) held claims 1 2 and 3 valid, but not infringed by a camera in which the film is moved by frictional contact alone although such construction is within their terms if construed without reference to the words substantially as described But they held these claims were infringed by a camera in which the film is moved by a reciprocating two-tined fork carrying studs or pins which engage perforations along the edges of the film This construction was considered the substantial equivalent of the sprocket wheel of the patent Claim 4 was held void as too broad. It differed from claim 3 of the original by the additional words the periods of rest being greater than the periods of motion

The reissued patent was again reissued as No 13 329 with five claims Claims 1 2 and 3 thereof are the same as the corresponding claims of the previous reissue Claim 4 differs from claim 1 in stating that the feeding devices comprise means proportioned to cause the devices to so advance the film that its periods of rest shall exceed its periods of motion Claim 5 differs from claim 1 in stating that the film is perforated and specifying that the feeding devices are provided with teeth engaging the perforations of the intermediate section

In a suit brought by the Motion Pictures Patent Company (owners of the Edison patent) against the Chicago Film Exchange the validity of the reissued Edison patent was again passed upon The lower court held the claim covering the photographic film infringed but on appeal the decision of the lower court was reversed the court taking the position that the long pliant translucent celluloid film with the sensitized surface was the invention and improvement of others. The pictures taken on such a film are photographs The invention of Edison was exhausted with the construction of a camera which enabled the photographs of moving objects to be taken on the Eastman film in the distinct, uniform and satisfactory manner justly claimed for them The pictures taken are the direct result of the mechanism of the camera with the Eastman film mechanically adapted to and applied thereto' The perforations along the edges of the film at regular intervals, into which perforations the teeth of ratchet wheels entered to give it the required motion was regarded as a mere mechanical contrivance devoid of patentable novelty

A large number of patents have been granted for various improvements in motion picture machines, and to describe them all would fill a large volume. An interesting apparatus was patented by R. D Gray, No. 540,545, June 4th, 1895. Referring to Fig 4 the film *D* is shown passing from the reel *F* to the reel *L*. The film receives two series of exposures, the individual exposures being made [illegible]nately on opposite sides of the median line of the film and through a single lens

B A segmental mirror *E* shown in elevation in Fig. 3 consists of a half circle of silvered glass, the other half of which is transparent This mirror is rotatably mounted so that its plane of rotation intersects the axial line of the lens at an angle of forty five degrees, and thus during each rotation the light is alternately allowed to strike the film at *C* and then reflected to strike it at *C″* The film guides are so arranged that the exposures at *C* and *C″* are on opposite halves of the width of the film The film is advanced intermittently by two rods *v* and *v′* operated by cranks, the free end of each rod being forked and the tines bent at right angles to engage perforations along each side of the film The forks act alternately so that while the film is being exposed while at rest at one place it is being advanced at the other For projection, a device similar to the camera is used with the addition of two lamps, one in the axial line of the lens opposite *C* and the other at right angles thereto opposite *C″*

The motion picture machine and the phonograph have both reached a high degree of perfection The next step is to connect the two machines so that they will operate in unison Motion pictures unaccompanied by sound give the effect of pantomime On the other hand, the effect produced by the phonograph alone is in many instances as unsatisfactory as the effect produced by a singer or speaker who cannot be seen by the audience The combined effect of motion pictures and phonographic reproduction is necessary to give complete illusion For this purpose substantially complete synchronism between the two machines is necessary in order that each movement shown upon the screen shall be accompanied by the sound originally produced simultaneously therewith Attempts have been made to accomplish synchronism by mechanical connections between the two machines and also by connecting them electrically It is claimed that mechanical connections are not effective since the slightest slip between the parts or any inaccuracy in construction destroys the synchronism As for electrical connections, it has been stated the cost of equipment and maintenance of special electrical apparatus is prohibitive Be that as it may the fact remains that in spite of repeated efforts for a number of years, this feature has not as yet been placed on a practical commercial basis. Mr Edison claims to have solved the problem in his recently exhibited kinetophone, but he is unwilling as yet to publish the technical details of construction The patents along this line are all of rather recent date. The patent to Gaumont, 752,884, February 16th 1904 discloses an example of synchronizing by electrical connections. Referring to Fig 6, the phonograph *L* is driven at a constant speed by any desired motor *Z* The motion picture machine A is driven by a motor which has the coils of rotor *B* connected to a source of electrical energy *I*, while each section of the stator *A* is connected with a section of the collector *C* This latter connection consists of insulated wires formed into a cable *O* Brushes *D* and *E* are rotated around the collector by the gearing *M N* connected with the phonograph The said brushes are connected to insulated rings *e* in contact with brushes *d e*, connected to the two poles of a source of electrical energy *J* When the brushes *D* and *E* are rotated, corresponding polarities are produced in the stator *A*, the law of displacement of which is the same as that of the brushes. Consequently, the rotor *B* will exactly follow the movement of the brushes which are positively driven from the phonograph. In operating this apparatus the phonograph is started with the motion picture machine disconnected. At the exact moment when a pre-arranged signal is given by the phonograph, the motion picture machine is started by means of the clutch *F*

A MAN feels more responsible and self-respecting while attending to a machine than when acting the part of a chambermaid to a horse in a livery stable.

Waverley

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LIMOUSINE FOUR PRICE $2 900

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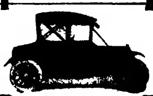

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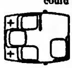
That has factory equipment for the manufacture of every type of electric vehicle, from the smallest runabout or brougham to a mighty five ton truck -

—And whose experience, gained in the making of this unlimited range of elec trics, enable them to evolve this most elegant, comfort able, and convenient of all four passenger electrics.



Without such experience, and the knowledge gained thereby, such an achievement would hardly have been possible

It took the company who built the first coupé electric—the first electric with the high efficiency shaft drive—the first electric which could take either solid or pneumatic tires—the first electric with full elliptic springs and patented drop sill construction—and the first five-passenger full view ahead electric to orig inate and design

The Silent Waverley Limousine-Four

In this wonderful car four sepa rate Pullman chairs replace the usual forward and backward seats. Three face forward, the fourth is a "cosy corner" in front at the right.

Thus affording full four-passenger capacity without obstructing the view of the driver, who sits as usual in the left-hand rear seat—the pleasant and sociable position, with, instead of in front of the other occupants of your car

This arrangement insures ample and delightful spaciousness and absolute freedom from crowding—no crushing of handsome gowns and wraps in the Waverley Limou sine-Four—while permitting of greater luxury and greater elegance than has ever before been possible in a four passenger electric.

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Waverley patented drop-sill construction permits of a beautiful, graceful low hung body swung on full elliptic springs as shown in the illustration—a combination which insures easy riding over every road and with any tires while saving current, increasing mileage and protecting your car from racking bumps and jars.

Batteries are flushed from outside the car—no lifting out of cushions with greasy hands, no spotting with water or fabric-eating acids.

The Limousine-Four will be on exhibition at the leading automobile shows, where prospective electric car owners can personally judge of its perfection—

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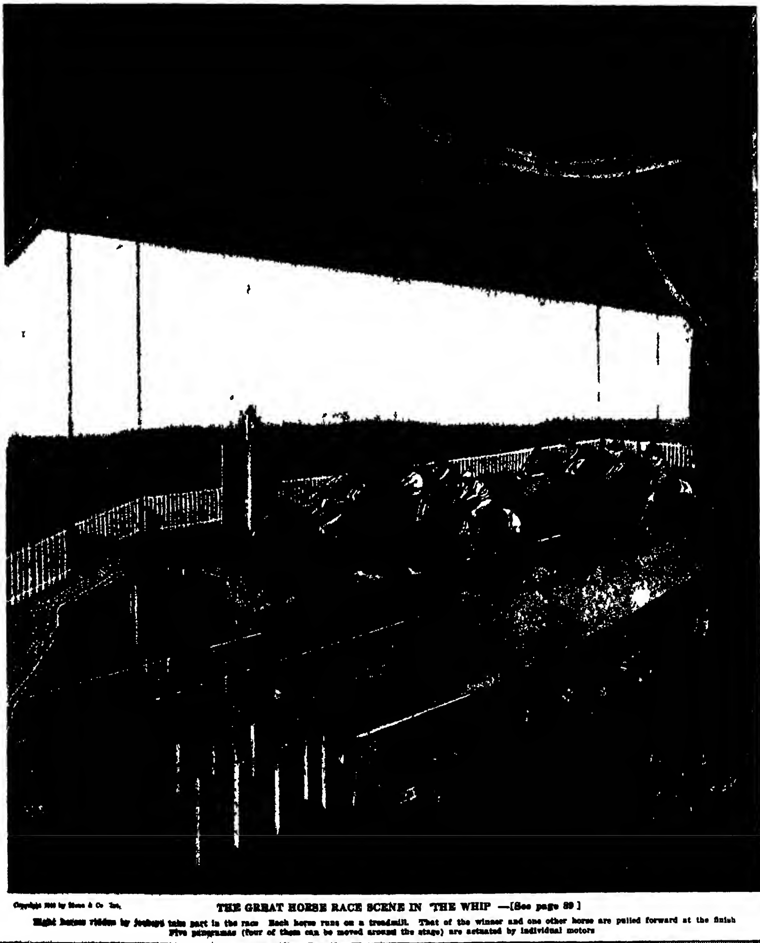

THE GREAT HORSE RACE SCENE IN "THE WHIP."—[See page 89.]

Eight horses ridden by jockeys take part in the race. Each horse runs on a treadmill. That of the winner and one other horse are pulled forward at the finish. Five panoramas (four of them can be moved around the stage) are actuated by individual motors.

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are sharp, the articles short and the facts authentic the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly the world's progress in scientific knowledge and industrial achievement

Amend the Panama Canal Act

SUFFICIENT time has elapsed since the passage of the Panama Canal Act last summer for a widespread national discussion of that much debated measure From platform and pulpit, in the magazine and the daily press, the question of free tolls has been so intelligently thrashed out, that the general public or at least the thinking part of it, has to-day pretty well made up its mind as to the wise and just course to pursue in extricating the Government from its present admittedly difficult position

The provision for free tolls, which is the only question in the Act that has been subjected to serious criticism has been attacked on the dual ground of morals and economics. Our objections on the ground of international morality have been clearly stated and are well known to our readers. It is not our purpose to enter into that side of the question again, for we believe that under the new light which has been shed upon the economic side of the question by the report of Prof Emory R Johnson, there will be found ample justification for an amendment of the act so far as the canal tolls are concerned—a procedure which we believe would be in harmony with the present state of public opinion and would furnish Congress with a means of dignified withdrawal from its present debatable position

Without disparaging the weight of the argument based on the moral aspects of the question we believe that the question of tolls will be fought out and finally settled mainly on economic grounds Furthermore, we believe that the Senate in putting the free toll provision into the act was moved thereto by a laudable desire to promote in a just and honorable way, the best interests of American shipping During the months which have intervened since the passage of the Act however two important factors have entered into the problem which to our thinking, have entirely changed its whole aspect These were the publications of Prof Johnson's report on the financial side of the question and the fuller realization of the fact that the leading maritime nations were remitting canal tolls to ships using the Suez Canal, and would probably follow the same course with regard to the Panama Canal

Prof Johnson shows that under existing conditions, coastwise ships sailing between the east and west coasts of the United States are already paying over $4 per ton for the carriage of freight across the Isthmus by the Panama Railroad and doing a lucrative business at that He points out that the payment of the $1.20 per ton toll through the Canal would still leave a wide margin of profit for the coastwise trade. The argument is simply unanswerable It has swept the ground from beneath the feet of those who claim that the tolls should be remitted to coastwise shipping in order to stimulate and develop it The people of the United States thanks to Prof Johnson's analysis, are now perfectly satisfied that the exclusion of foreign shipping from our coastwise trade has given to the latter all the assistance that it can reasonably demand from the Federal Government There is a widespread conviction that to remit the tolls to these ships alone would be to make a gratuitous gift of money from the Treasury to private corporations that stand in no need of it whatsoever

Furthermore there is a growing understanding both inside of Congress and outside, that the repeal of this section of the Act will not prevent the Federal Government from rendering financial aid to the American Merchant Marine should it feel disposed to do so, for, if a flat rate is charged on all shipping, domestic and foreign alike, there will be nothing in the much-disputed treaty with Great Britain to prevent the Government from making a remission of tolls, in whole or in part, to American shipping using the Canal, should it see fit to do so. Obviously, the first step in this policy should be the passing of an amendment to the Panama Canal Act by which its present objectionable feature would be removed.

Two bills for the amendment of the Act are now before Congress, one in the Senate, introduced by Senator Root, the other presented in the House by Representative Simms. Their passage will afford a complete escape from the present *impasse*

It will raise the prestige of Congress to rectify its error by a regular and dignified procedure, which will at once remove the existing misunderstanding with a friendly power and place the Government in harmony with the best traditions of our National policy Furthermore, the passage of these bills will save Congress from the humiliation of having to arbitrate a law which lacks the moral support of the country at large.

Mis-statements in the Oldfield Report

ALTHOUGH no evidence of the actual suppression of inventions was given before the Committee on Patents to which the Oldfield Bill was referred we find in the report submitted by the Committee statements which seek to keep alive that false impression and which are in the main mislead ing Indeed, the Committee was compelled to go outside of the testimony which it took, for proof of suppression In its report it declares "It has been the subject of comment and complaint in the public press for years. Moreover, many instances can be found in the reports of the decisions of the Federal courts"

Quoting from Columbia Wire Company v Freeman Wire Company (71 Fed, 302, 306) the Committee says regarding one of the parties litigant "It has become possessed of many if not all, of the valuable patents for the manufacture of barbed wire and machines for so doing" Examination of the opinion of the court shows, however, that this quotation is merely one clause in a sentence and that the remainder of the sentence and the context flatly disprove every suggestion of suppression either of patents or competition The court really says "It has become possessed of many if not all, of the valuable patents for the manufacture of barbed wire and the machines for so doing and has granted a large number of licenses to persons and corporations under its said patents. The evidence further shows that it has not bound its licensees to any prices, or in any manner limited or restricted their sales or output In other words, there appears to be so far as the complainant's licensees are concerned unrestricted competition in the sale of their products."

The Committee cites a finding of the court in Indiana Manufacturing Company v J I Case Threshing Machine Company (148 Fed 21), but fails to publish the fact that the decision in that case was unanimously reversed by the Circuit Court of Appeals of the Seventh Circuit (154 Fed, 365) So, too, the case of National Harrow Company against Bement (21 A D N Y, 290), a decision by a New York court of intermediate jurisdiction cited with approval by the Committee eventually went to the Supreme Court of the United States, where it was unanimously reversed. (Bement v National Harrow Company, 186 U S., 70)

Contrary to the impression conveyed by the Committee's report the so-called "Lock Case" (Blount Manufacturing Company v Yale & Towne Manufacturing Co., 166 Fed., 555) did not involve the purchase of patents for "purpose of extinction," but raised the question whether an agreement to restrain trade in respect to both patented and unpatented locks was contrary to the Sherman Anti Trust Act, and the court, of course, held that it was. Far from indorsing the objects of the substitute Oldfield bill, the court in this case emphatically dissents from the Committee's position, saying "The right of a patentee to suppress his own rests upon ordinary considerations of property rights. The public has no right to compel the use of patented devices or of unpatented devices, when that is consistent with fundamental rules of property"

The Committee also quotes from the famous "Paper Bag Case" (Continental Paper Bag Company v Eastern Paper Bag Company, 150 Fed., 741; 210 U S., 405), the opinion of a dissenting circuit judge who differed from the majority of his colleagues and from the decision of the Supreme Court of the United States. This the Committee describes as the "best known instance in the reports of suppression of a patent to prevent competition." This assertion by the Committee is important, because in this case, as the Supreme Court pointed out in its decision, we find a clear instance, not of the willful suppression of a patent, but simply of the rejection of an invention, and a use of a better invention accomplishing the same purpose more satisfactorily

The conclusion of the Committee that "these citations are sufficient to show that the practice of buying up and suppressing patents is widely indulged" is wholly unwarranted. The contention that the aggregation of patents under single ownership is a monopoly was disposed of by the Court of Appeals of the Seventh Circuit in one of the very cases relied upon by the Committee (Indiana Manufacturing Company v J I Case Threshing Machine Company, 154 Fed., 365, 371) by the following *reductio ad absurdum* "Their contention comes to this If he owned either alone, over that he would have complete dominion, owning both, he controls nothing The public has no right in either invention, therefore, the public has the right to have them both in the market competing for buyers. Naught plus naught, the sum of the two naughts is a substantive quality"

The value of the "comments and complaints in the public press," which the Committee mentions as proving the suppression of inventions, does not merit serious discussion. Not a single instance of such "comment and complaint" is specified in the Committee's report "I wanted," declared the Chairman, when he presented the report to the House, "to get up as good a report as we could, to make it as plain as possible" Since this is the best showing the Committee can make in respect to suppression of inventions, it is not presumptuous to affirm that present conditions require no change in the patent law upon this point

Modern Psychology

PSYCHOLOGY is the study of consciousness. To-day it is a science, a knowing, but this could hardly have been said of it before our era Psychology is no longer given up to metaphysical speculations, to philosophic inquiry concerning the nature of the soul, the future life, spiritual states, and the like Such are very legitimate considerations, but they have only an indirect and not an essential relation to modern psychology

This science, in the present day sense, originated in the work of Weber and Fechner early in the nineteenth century, but it had no independent standing as a science until 1878, when Wundt (who had his eightieth birthday in August of last year) established his laboratory in Leipzig, where so many "experimentalists," both European and American, have been trained. Prof. G Stanley Hall, in his "Founders of Modern Psychology," considers that "psychology owes to Wundt a debt far greater than to any other man living or dead." Presently Müller, Martius and Ebbinghaus followed Wundt's example in Göttingen, Bonn, and Berlin, respectively within fifteen years sixteen experimental laboratories were established in America, all directed by Americans, except that presided over by Münsterberg at Harvard. And at Harvard the lamented William James prepared his superb treatise, the reader of which readily subscribes to the *mot* that "William James, the philosopher, writes like a novelist, while his brother, Henry, the novelist, writes like a philosopher"

Psychology is now an eminently practical science, and its development has been so great that it has in its turn become divided into branches—or shall we not say distinct sciences. These are the physiological psychologists, who devote themselves exclusively to work upon the anatomy, histology and physiology of the brain, the organ upon which mind is conditioned and in which mind manifests itself most. Then there are the experimental psychologists, who get their data at first hand from study of the conscious, sentient being, human or animal or plant, these experimentalists seek to correct the irregularities and errors of individual observers by objective tests. They eliminate, as far as possible, the personal equation, by the use of accurate instruments in testing data. They deal with a very wide range of problems, as witness one of their meeting programmes. the differential perception of colors in the spectrum, geometrical illusions, the influence of rhythm upon the circulation of the blood, the influence of such substances as tea and hashish on psychic processes; the psychology of the telegrapher; respiration in relation to attention; the development of voluntary motion in the child, the mental faculty and sensation measurements in school children and university students, variation in the nests of the spider; measurements of the variability of instinct; the psychology of the ant queen, the sense and intelligence of the Japanese dancing mouse, etc.

Obviously modern psychology is an important science, because it seeks to measure and to normalize consciousness, that is, psychism or mentality This psychology is really the handmaiden of all the sciences, because all valid scientific conclusions are achieved only through sound mentality.

Engineering

A Turbine- and Reciprocating-engine Competition.—What a fine opportunity for judging the relative efficiency of the turbine and the reciprocating engine was afforded by the recent run of the "Arkansas" and "Delaware" from Colon to Key West at a speed of 18 knots The reciprocating engines of the "Delaware" have some fine records to their credit, and since the "Arkansas" is fitted with the latest type of turbine, the run should afford some excellent and most valuable data as to the relative efficiency of the two types, at least at a speed of 18 knots.

Removing Railroad Grade Crossings.—In view of the growing number of fatalities at grade crossings, the Legislature of New York State should give favorable consideration to the recommendation of the Public Service Commissioner of the Second District that $500,000 be appropriated for eliminating grade crossings of highways and steam railroads. It will surprise some of us to learn that there are at the present time over eight thousand of these crossings in the territory which is covered by the Commission of the Second District alone

Solidifying of the Gatun Dam.—According to that excellent publication, the *Canal Record*, the hydraulically-deposited core of the Gatun dam is now practically covered in by the dry fill. The deposited material is a smooth clay, highly waterproof which has flowed into every interstice in the rock and earth, until the whole mass at the center of the dam has become like a rubble wall, every rock of which is cemented to another This clay is similar to the blue rock found everywhere on the isthmus, and the *Record* states that it is probable that in time the core of the dam itself will solidify into such rock

One-man, Gun-fire Control—The ideal method of firing broadsides from a battleship would be one in which all the guns were given the same training and pointing, simultaneously by one man—provided of course, he is possessed of better training and elevating abilities than the average of the ten or a dozen separate men who do the work at present. Sir Percy Scott has perfected a system by which all the guns can be trained and elevated simultaneously by one man from a given station The latest report states that this method has shown a great superiority in target practice over the old system of separate pointing and training

Large Dipper Dredges.—The excavation of the Atlantic entrance to the Panama Canal called into service dipper dredges of unusual size and capacity The "Mindi" and "Chagres," which are cutting the entrance channel to a minimum depth of 42 feet at mean tide, are working entirely in rock which has been previously broken up, and they bring the material to the surface in 5-yard dippers. The dipper handles are 62 feet in length and the boom supporting the shipper shaft is 50 feet long To facilitate the work the dredges have been equipped with steam dipper trips which have shown good results during six months of work

High-speed Trains in Germany—The 1912 summer-time table of the German Railway Systems, says *The Engineer*, provides an interesting study, for it reveals that a new era of rapid transit has dawned in that country In 1911 a non-stop run from Berlin to Hamburg in three hours and twenty minutes was inaugurated, and in 1912 the run was further accelerated The train left Berlin at 8.55 P M, reaching Hamburg, 178¼ miles distant, at 12:09 A M, the speed being 55 1 miles per hour The return journey was made at 54.5 miles per hour The train was a light one, consisting of four four-axle carriages and a six-axle dining car

Safety Railroading—The Pennsylvania Railroad, co-operating with other lines in the eastern territory, has inaugurated a railroad safety movement, which is the latest move of many made by the company to increase the safety of passengers and employees on its system "Safety First" meetings are to be held in several important centers, in which lectures illustrated with photographs, lantern slides, and statistical tables will be delivered We are glad to note that other leading railroads are moving in the same direction, for we regard this "Safety First" movement as one of the most effective agencies for reducing our present shocking annual railroad list of killed and injured.

The Gas-electric Motor Car—Railway officials have been watching with interest the development of the self-propelled car for use on steam roads. Under steam operation, short branch lines, carrying a limited traffic, are notoriously unprofitable Single units running at sufficiently frequent intervals give a more satisfactory service than the larger once-a-day trains, and the managers have turned to the self-propelled car as offering a solution of the problem. To-day over twenty railroads have self-propelled units of the gas-electric type running on regular local schedule. The consumption of gasoline, while varying with the local conditions, is found on the average to be low, the economy being due to the electric transmission, which lends itself admirably to the particular requirements of local service.

Science

A Yearbook of Agricultural Statistics is the latest periodical publication to be undertaken by that remarkably prolific institution, the International Institute of Agriculture The initial volume, published in 1912, gives statistics for the years 1901 to 1910 from the fifty countries adhering to the Institute, representing practically the whole of the civilized world All the data are from official sources

The Rice-growing Congress—The fourth international congress of rice growing was held at Vercelli Italy, during the early part of November It was decided to establish an international center for rice cultivation and researches upon this subject and accordingly the Vercelli rice-growing plant is to be rearranged and laid out with this end in view The institution will be directed by Prof N Novelli and it is expected to further the interests of this branch of research to a considerable extent

Feeding Plants to Keep Them Warm—It is well known, of course, that human beings and the lower animals are better able to resist cold when they are well fed, but it is interesting to learn that a German investigator has announced that feeding plants has the same effect on them He declares that the introduction of organic substances of nutrient character (carbohydrates, alcohols, acetone) into the plant cell heightens its resistance to cold, even in the case of tropical plants Different substances protect in different degrees The sugars stand highest, then come glycerine, the alcohols, and acetone The removal of the protective contents restores the original degree of resistance

Amundsen Receives a Gold Medal from Peary—On January 11th Capt Roald Amundsen, discoverer of the South Pole, received from the hands of Rear-Admiral Robert Peary, discoverer of the North Pole, the gold medal of the National Geographical Society Replying to the brief speech of presentation, Capt. Amundsen said "Greatly as I am honored by receiving this beautiful medal, I feel that the honor is multiplied a thousandfold by the fact that the presentation has been made by the greatest explorer since Christopher Columbus The desire to search out the South Pole, in fact, the spirit for exploration and discovery was awakened in me by Admiral, then Lieut, Peary whom I met in the Arctic in 1890 "

Right and Left Handed Plants—Do you know that there are right handed plants and left handed plants? An English investigator, R H Compton, has thought the matter curious and interesting enough to make it the subject of extended investigation, and has reported on it to the Cambridge Philosophical Society He observed eight varieties of two-rowed barley to determine the ratio of rights to lefts, in the first leaves of seeds of different varieties and of the various kernels from the same individual spikes, and found that among 12,401 seedlings 7,237 or 58 36 per cent had the first leaf twisted to the left A variety of millet showed an excess of left handed seedlings as was also the case with oats In the case of corn, the ratio was almost unity and there was apparently "no inheritance of right and left handedness as such

The Meteorological Service of Brazil has been completely reorganized and placed under the Ministry of Agriculture, Commerce and Industry of that country About 150 stations are already in operation, and it is planned to greatly increase this number by having each State establish a central observatory and a local network of stations to cooperate with the central institution in Rio Janeiro Several stations will soon be established in the remote interior, at places to which access is slower and more difficult than a journey to Europe At present nine tenths of this vast country is a meteorological *terra incognita*, representing a deplorable blank on the climatic charts of the globe The shining exception to this condition of affairs is the famous coffee-producing State of São Paulo, which has long maintained an excellent meteorological service on its own account The director of the new national service is Prof Dr Henrique Morize

Expedition to the Karakoram.—Dr Filippo di Filippi, well known as an associate of the Duke of the Abruzzi in his mountaineering enterprises, is preparing to lead a scientific expedition to the Western Himalaya and the Karakoram, which will probably be the most important undertaking of its kind ever conducted in that region The proposed route lies from Kashmir over the Himalaya range and through Baltistan and Ladakh into Chinese Turkestan. The problems to be investigated concern topography, geology, gravity, magnetism, and meteorology, including the various forms of radiation and atmospheric electricity The upper air is to be sounded with kites sent up from stations of high altitude—a particularly interesting undertaking, for the reason that the Himalayan explorer will be able to start his kite at a level corresponding to the greatest heights above sea-level heretofore attained by the kite itself in other parts of the world The estimated expense of the expedition is $50,000, of which $30,000 has already been raised

Aeronautics

A New Height Record in an Aeroplane—On January 10th Maurice Chevillard made a new world's record for three passengers He rose to a height of 4,921 feet The ascension was made at Buc, France

A Life Saver for Airships.—Francois Rilleau, of Los Angeles, Cal, has patented No 1 046,023, a safety device for airships in which a collapsible parachute cover is opened by a spring and frames fastened to the airship fold over the parachute cover and are held by a latch to secure the parachute out of operation until necessity for its use arises.

A Novel Envelope for Aerostats.—John R Gammeter, of Akron Ohio has patented, No 1,047 838 an envelope for gas containers, for aerostats, composed of a fabric woven of metallic ribbons and he forms this envelope with a body portion of tightly woven metallic ribbons and with end portions of sheet metal the ribbons being woven so that they present substantially no interstices

Flight Across the La Plata River—A remarkable flight of 120 miles over water was made from Buenos Aires to Montevideo on the 2nd inst by Corporal Fels The distance covered was 120 miles and the time of the flight something over two hours The flight was made down the river which is 80 miles wide at its mouth The young corporal is a student of engineering who is doing one year of military service He pilots a Blériot monoplane

Curtiss Flying-boat for the Army—The flying-boat built by Glenn H Curtiss has been successfully tested at Hammondsport, N Y In the climbing test the machine rose to an altitude of 1 200 feet in 6½ minutes The average speed was 54 8 miles an hour in a 10-mile wind blowing diagonally across the course During a two-hour duration test a total weight of 900 pounds was carried, which included the weight of the aviator and passenger

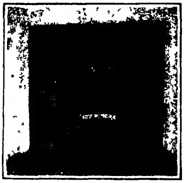
Testing the Twin-engine Principle—According to *Flight*, Lieut Seddon on the Short twin-engine biplane recently rose from Eastchurch to a height of 6,400 feet. Then coming down to 900 feet he cut off one engine, and made a flight of about 9 miles to the south of Sheppey and Leysdown, finishing up with a volplane from 500 feet It has been stated, as a result of this experiment, that should one motor fail at a height of 5,000 feet, the machine would be able to travel a hundred miles without alighting on the water

An Air Scout Killed—According to a dispatch published in the New York *Times*, a war aviator, Dr Jules Constantin with the Bulgarian army was killed in battle On his final flight he left Furna, a small village before the Tchatalja lines, in a biplane, and rapidly disappeared from view When the machine returned and descended, his comrades found him lying dead on the ground with a wound in his chest The wings of his biplane were riddled His barograph showed that he had attained a height of 4 000 feet above the Turkish forts He had just enough strength left to guide his machine toward the Bulgarian camp

Italian Aviation The Italian army is coming to the front in the use of hydroplanes and among other performances we may mention the brilliant flights made by Lieut Ginocchio upon his Paulhan machine at Venice alighting at times amid the numerous gondolas Paulhan, who was on a visit there also made flights before the Italian officers The government is taking up the hydroplane question very actively, and is installing aeroplane posts all along the coast It intends to use Borel hydroplanes quite extensively and has ordered nine of these to be delivered to the Venice arsenal in three months The first hydroplane fleet is now setting out to make over-sea flights, and the pilot Chomet is to make evolutions over the Adriatic On the other hand, the Austrian war department has just ordered one of the newest Paulhan-Curtiss hydroplanes known as "flying boat "

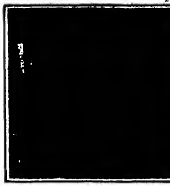
Hydrogen for Military Dirigibles The production of hydrogen for the airships of the war fleet is organized on an extensive scale in Germany All military airship headquarters have their own hydrogen plants located in the vicinity so there are now twelve plants of the kind At Altona near Hamburg, there is a station near the sea coast for airships which are in use with the navy, and the centers of Berlin and Frankfort have each two hydrogen plants Six of the stations lie along the west frontier The new hangar constructed at Frankfort especially for the airship Victoria-Louise" of the Zeppelin type receives hydrogen direct from the Griesheim chemical works by a pipe line 2 7 miles long which is the first of the kind in Europe Using high pressure the delivery of gas per day is as much as 30 000 cubic feet Autogenous welding is used for the pipes so as to prevent any leakage of gas The pipe line ends in a gas holder of 200 000 cubic feet capacity and upon it are eighteen separate outlet taps for taking off gas for the airship's use As these outlets are situated in the hangar itself, it is an easy matter to fill out all the ballonnets of the airship at the same time

Part of a film, showing motions in assembling a braiding machine



The Gilbreth chronometer

At the December meeting of the American Society of Mechanical Engineers a remarkable development in scientific management was disclosed during the discussion of the report of the sub-committee on administration. As will appear from the following article, the development consists in using the moving picture camera to record the number of motions made and the time consumed for each.—EDITOR.



One of the experimental packets.

Part of a film, showing motions made in using hammer.

Micro-motion Study

A New Development in Efficiency Engineering

IN almost every book on efficiency engineering much space is devoted to what is called "motion study." The number of motions made by a workingman or a tool and the time occupied in performing these motions are accurately determined so far as possible. Hitherto the time element has been controlled by means of a stop watch in the hands of a trained observer—no easy task when it is considered that very often hundreds and even thousands of motions and operations must be studied and timed. The more expensive the study, the more likely are errors to creep in.

In order to reduce the labor involved in these painstaking investigations, and above all to eliminate the possibility of error, Mr. Frank B. Gilbreth, a very well known efficiency engineer who has made a specialty of motion study, has invented an entirely new method, which consists in using a moving picture machine in connection with a special chronometer or "clock," as it is termed in the parlance of scientific management.

At the December meeting of the American Society of Mechanical Engineers, Mr. John G. Aldrich of Providence and Mr. Robert Thurston Kent of New York revealed this new method in all its details. So interesting was the subject that it was discussed during an entire session of the Society on a Friday morning and during a supplementary session which lasted until late into the afternoon.

Mr. Gilbreth's special clock makes ten revolutions per minute. Its dial has one hundred divisions, each of which, therefore, represents a time interval of one one-thousandth of a minute.

In studying the motions required to assemble a machine, for example, the chronometer plays as important a part as the object studied. It appears prominently in every one of the hundreds of pictures taken by the moving picture machine. Alongside the chronometer, an ordinary twelve-hour clock, which fixes the time of day, is placed so that in the moving picture film, complete information regarding the time study is included.

Every film reveals the successive positions of a workman in performing each minute operation of the task intrusted to him. The position of the chronometer pointer in successive films indicates the length of time between successive operations. These films are studied under a microscope, and a careful analysis of each operation is made to develop the standard time for each. The interval between the successive films in one study was a little under three one-thousandths of a minute. Obviously such accurate time studies of minute and detailed operations can hardly be made by means of a stop watch. Fine as that study was, it can be made much finer. Chronometers can be used which make one revolution in one thirtieth of a minute, and the dials being divided into hundredths, it is possible to obtain time studies of greater refinement than at present appear necessary. "Micro-motion study" is the name which has been given to this method of recording and studying minute motions or parts of motions. The film is far more than a record of time. In the discussion before the American Society of Mechanical Engineers, it was pointed out that it will serve as an instruction card which may be enlarged and passed from workmen to workmen to teach the best methods of doing work. A film shows a workman not only what to do, but how to do it to the last detail, and, therefore, teaches him what printed instructions and books can never impart adequately. It also shows him the time which the most skilled workingman required for a given piece of work, and which can be equaled if that workingman's motions are mimicked.

Any workman may, for a time, deceive an inexperienced efficiency engineer by "soldiering." But the camera cannot be deceived. The film records faithfully every movement made, and subsequent analysis and study reveals exactly how many of these movements were necessary and how many were purposely slow or useless. Hence by the elimination of the useless movements a most economical method of performing a given piece of work can be attained.

In the Providence works of which Mr. John G. Aldrich is vice-president and general manager, experiments in micro-motion study were made which involved the assembling of braiding machines. Originally the parts were assembled by bringing them to the job in boxes, from which they were taken by the worker, as he required them, and assembled at an ordinary work bench. In transferring the individual pieces to the growing machine many motions were unnecessarily made, all of which were disclosed by the moving picture machine. One result of this micro-motion study of assembling braiding machines was the provision of a bench which brought the top of the completed machine at a convenient level for the workman, and the arrangement of the parts in an orderly manner in bins behind him. Although the number of motions was thus considerably reduced, there were still more than were absolutely necessary. Experience in other trades has shown that it is often desirable to group units composing a single assembly on a "packet" and to arrange them in the order in which they are needed. A similar packet scheme was adopted for the parts of the braider.

The moving picture camera photographing a workingman's motions. Note the clocks.

First a horizontal packet was made up and the motion picture machine disclosed an irregularity and lack of rhythm in the movements of assembling, which seriously cut down the efficiency of the workmen. Then a vertical packet was tried and a standard type of portable assembly bench was thereby indicated. After a few experiments a highly efficient arrangement was devised. The various parts were hung on pegs in the exact position that micro-motion study had revealed as the most economical of motions both as regards time and length of travel. Thus the method permitted the development of the finally accepted method in a small fraction of the time and expense which would have been necessary under the conditions which existed before its invention.

Sawdust Briquettes

A NEW industry may be successfully combined with the planing mills—that of making of the sawdust briquettes to be used for firing under the boilers, thus considerably decreasing the cost of the fuel to the mill owner. This is being very advantageously done in Germany. The sawdust is automatically gathered and conveyed to a place near the presses. From here it is carried over a heated belt-conveyor to a drying room. This is a cylindrical revolving drum about 2 feet in diameter and 20 feet long. In this drum the sawdust is partially dried, the pitch contained in the wood is softened, acting hereafter as a binder. From here the sawdust is conveyed over an incline to the after-dryer of the same shape as the first dryer, which forms a part of the press. Here it is submitted to a higher temperature to drive off all the moisture, and kept running forward toward the end of the after-dryer by rotating paddles. At the end of this after-dryer, the sawdust falls through an opening into the trough of the press, which is a simple angle-lever press. The drive is of the usual shifting belt type, the fixed pulley acting as a flywheel. At the end of each pressing operation, which takes places about 24 times a minute, a briquette is made about 6½ inches by 2¾ inches by 1⅛ inch weighing between one half and three quarters of a pound. From the press the briquettes are carried by another belt-conveyer to a cooling room and are then ready for use. As the installation is very cheap, costing in Germany only $24, it should recommend itself to the attention of sawmill owners, who could utilise to great advantage a heretofore mostly wasted product of their mills.

Russia Forbids Crossing of Frontier in Aeroplane or Airship.—The Russian Cabinet recently issued an order prohibiting foreign aeroplanists and aviators from crossing the western frontier for six months.

Morning and Evening Stars for 1913

Graphic Representation of the Planets and Their Movements During the Year

By Professor Frederic R. Honey, Trinity College

THE changes in the relative positions of the planets as exhibited every year in "Morning and Evening Stars" afford a pertinent illustration that in nature there is no such things as repetition, and while a supreme law pervades and controls every variation in planetary positions, yet each planet yearly occupies a different place in its orbit, and in relation to its fellows, producing conditions which are always unique in planetary combinations. The presentation of "Morning and Evening Stars" thus includes an opportunity to locate each planet, and incidentally to review annually the principal elements of the Solar System.

The Sun.

The sun, whose mass is about seven hundred and fifty times the sum of the masses of all the planets and their satellites, is a sphere whose diameter is 804,387 miles. It rotates on its axis in about twenty-five days in the same direction as that of the revolution of the planets in their orbits. Some idea of the great magnitude of the sun may be obtained by comparing its diameter with that of the moon's orbit, which is 477,702 miles. The sun is the only body in our system whose dimensions would be appreciable in the plot of the terrestrial planets, in which it would be represented by a circle whose diameter is less than one hundredth of the radius of the earth's orbit. At a distance of nearly ninety-three million miles, the sun's diameter subtends an angle of a little over ½ degree. At this distance the prominences which are visible during a total eclipse do not appear—the outline being that of a circle which may be represented to the observer by a disk one inch in diameter at a distance of about nine feet from the eye.

The Planets—Kepler's Laws.

The planets are conveniently studied in three groups—the Terrestrial planets, the Asteroids, and the Major planets. Since the radius of Neptune's orbit is between seventy-seven and seventy-eight times that of Mercury, it is impracticable to represent the orbits of all the planets in one plot. The orbits of the terrestrial planets are drawn to as large a scale as the limits of the page admit, and those of the major planets are necessarily plotted to a scale which is very much reduced. The great difference in the scales is evident by a comparison of the orbits of the earth and Mars in the two plots.

The plane of the ecliptic, which is the plane of the earth's orbit, is represented by this page, which for convenience of reference may be placed in a horizontal position. A planet may be described as above or below this plane, but it should be understood that this description is simply to aid the imagination, since there is no such thing as horizontal and perpendicular, or above and below in stellar space.

The planes of the orbits of the terrestrial and major planets form small angles with the plane of the ecliptic. The intersection of the plane of a planet's orbit with the ecliptic is the line of nodes, and the point N where the planet passes from the space below to that above the ecliptic is the ascending node. N′ is the descending node. Perihelion or point of nearest approach to the sun is at P.

The Terrestrial Planets.

MERCURY

On account of the great eccentricity of the orbit the planet illustrates more vividly than any of the terrestrial or major planets the first two of Kepler's laws of planetary motion: 1. The orbit of each planet is an ellipse with the sun at one focus. 2. The radius of the orbit sweeps over equal areas in equal times. The center of Mercury's orbit is at b at a distance from the sun of a little over one fifth of the mean distance between the sun and Mercury, and the area of the triangle with that part of the orbit between the positions at the dates August 22nd and August 30th with the sun as a vertex is equal to the area of the triangle with the same vertex and a base equal to that part of the orbit between the dates October 1st and October 9th. The planet accomplishes its revolution in very nearly 88 days (87.97), and the positions are shown at intervals of two days. In order to avoid confusion the date is attached only for every eighth day. Mercury's orbit is inclined to the ecliptic at an angle of 7 degrees. The mean distance from the sun expressed in terms of the earth's mean distance is 0.3871, the period (88 days) 0.2408, and $0.3871^3 = 0.05798 = 0.2408^2$ illustrating Kepler's third law, viz.: The squares of the periods of any two planets are proportional to the cubes of their mean distances from the sun. The orbital velocity of the planet is subject to great variations. At perihelion it moves at the rate of 35 miles a second; at aphelion the velocity is reduced to 23 miles a second.

VENUS

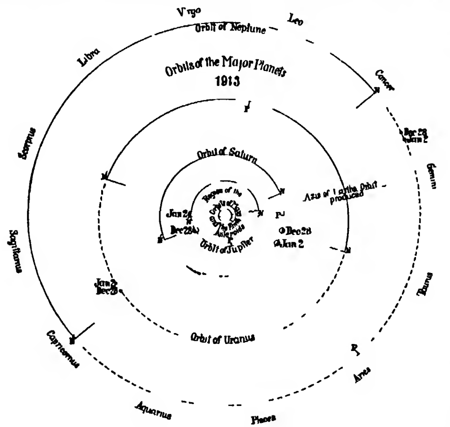
The eccentricity of the orbit is less than that of any of the terrestrial or major planets, its linear measurement being so small that it is scarcely visible in the plot. As a consequence Venus moves in a very nearly circular orbit at an almost uniform velocity of 21.9 miles per second. The plane of the orbit is inclined at an angle of nearly 3.4 degrees, and the planet's mean distance from the sun is equal to 0.723 times the earth's mean distance. The period of revolution is 224.7 days, and the position of Venus is shown at intervals of four days. On August 14th the planet very nearly reaches the position of January 2nd. The distance between these positions is that traversed in seven tenths of a day. The dates for the first revolution are attached without the orbit, those for the second revolution within the orbit.

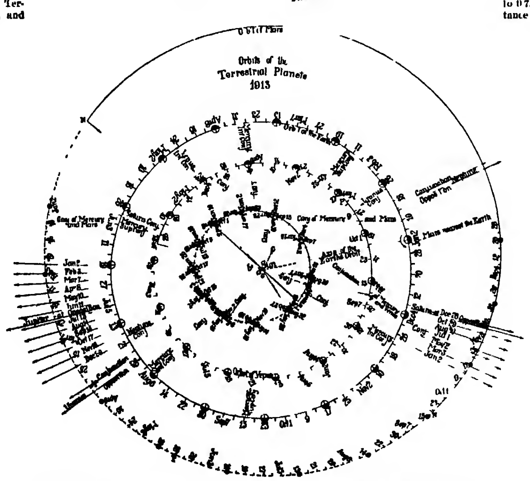
THE EARTH

The center of the earth's orbit is at a. Its eccentricity, c, representing a little over 1½ million miles. Thus in January our planet approaches more than three million miles nearer the sun than in July. At a mean distance from the sun of 92,894,767 miles the earth performs its revolution in 365.25 days at a mean velocity of 18.5 miles per second. The positions are shown at intervals of four days.

MARS

The great eccentricity of the orbit brings the center c at a distance from the sun equal to nearly one tenth of the mean distance of the planet. The plane of the orbit is inclined at an angle of 1.85 degrees. At a mean velocity of 15





ORBITAL MOVEMENTS OF THE MAJOR AND TERRESTRIAL PLANETS FOR 1913.

miles per second, and at a distance equal to 1.5237 times the earth's mean distance, Mars completes a revolution in 1 88 years. The positions are shown at intervals of four days.

The Asteroids.

For the purpose of this article it is not necessary to do much more than refer to these fragmentary bodies occupying the space between the orbits of Mars and Jupiter The elements of the orbits of seven hundred and fourteen of the planetoids have been tabulated, and the number is continually increasing Some of the orbits show great eccentricity, and are inclined at large angles to the ecliptic The distances of four of the most remote of these bodies do not differ very much from Jupiter's distance, and the orbit of Eros, whose period is even a little less than that of Mars, on account of its great eccentricity, comes very near the earth's orbit.

The Major Planets.

JUPITER.

At a distance from the sun equal to 5.2 times the earth's mean distance, Jupiter makes a revolution at the rate of 8.1 miles per second in 11.86 years. The eccentricity of the orbit, which is inclined at 1.3 degrees to the ecliptic, is a little over one half that of Mars. The direction in which the planet would be seen from the sun is shown in the plot at intervals of 32 days.

SATURN

Saturn's orbit, which is inclined at 2.5 degrees, shows a greater eccentricity than that of Jupiter The ringed planet's distance from the sun is a little over nine and a half times the distance of the earth, and its revolution around the sun, at a velocity of six miles per second requires 29 46 years.

URANUS.

The orbital eccentricity of this far distant planet is very nearly equal to that of Jupiter, but on account of its remoteness from the sun (which is 19.19 times the earth's distance) the linear eccentricity, or actual distance from the sun to the center of the orbit, is nine tenths the earth's orbit radius. The inclination of the orbit is only ¾ degree, less than that of any of the orbits of the terrestrial or major planets. At a velocity of 4.2 miles a second, Uranus completes a revolution in 84 15 years.

NEPTUNE.

The outermost planet, whose distance is 30 07 times the earth's distance, has a velocity of 3.4 miles per second, which on account of the small eccentricity is nearly uniform. The orbit is inclined at an angle of 1 76 degrees, and the period is 164.79 years. In common with all the planets Neptune conforms to Kepler's three laws of planetary motion.

Conjunctions and Oppositions.

The positions of the planets are shown in the plots at Greenwich noon The hour of the day when a conjunction or an opposition occurs is indicated by the measurement on the orbit.

TABLE I.—GREENWICH TIME.

Date.		Conjunctions.	Oppositions.
January	14		Neptune
January	23	Uranus	
February	12	Mercury (sup.)	
March	27	Mercury (inf)	
April	24	Venus (inf)	
May	20	Saturn	
June	1	Mercury (sup.)	
July	5		Jupiter
July	18	Neptune	
July	28		Uranus
August	4	Mercury (inf.)	
September	16	Mercury (sup.)	
November	22	Mercury (inf)	
December	6		Saturn

Mars comes nearest the earth on December 31st, but the planet will not come to opposition until January 5th, 1914, when on account of the eccentricity of the orbit, Mars will be a little farther from us.

Conjunctions of the Planets.

Twelve conjunctions of the planets occur during the year Only two are illustrated—those of Mars and Mercury, and of Mercury and Venus. The others may be discovered by the reader with the aid of a straight edge, which should be applied to the earth and the planets at the dates given in the table.

TABLE II.

Date		Planets.
January	9	Mercury and Mars
January	11	Mercury and Jupiter
January	13	Mars and Jupiter
January	31	Mercury and Uranus
February	25	Mars and Uranus
May	8	Mercury and Venus
May	31	Mercury and Saturn
June	23	Mercury and Neptune
July	21	Venus and Saturn
August	24	Mars and Saturn
August	20	Venus and Neptune
December	2	Mercury and Venus

How to Find Morning and Evening Stars.

Place the accompanying plot of the terrestrial planets in such a position that the earth at the assigned date is between the reader and the sun. The dates attached to the earth, Mercury, Venus and Mars, may then be seen without turning the head. A straight-edge passed through the earth and the sun will divide the planets into two groups. Since the earth rotates in the directions of the arrow (see position for January 2nd) the observer emerges at sun-rise from the shadow area, and the planets on the right rise before the sun and are morning stars. At sun-set the observer enters the shadow area, and the planets on the left of the plot as inspected, set after the sun and are evening stars. Between inferior and superior conjunctions Mercury and Venus are morning stars, and between superior and inferior conjunctions these planets are evening stars. Before conjunction a planet whose orbit is outside the earth's orbit is evening star, after conjunction it is morning star When a planet is at opposition it is above the horizon before and after midnight, and is both morning and evening star Following this method the morning and evening stars for any day of the year may be ascertained.

The New York Automobile Shows

NOW that the Selden patent is a thing of the past, the two big automobile shows which have generally been held heretofore by rival interests were this year—the thirteenth of these exhibitions—conducted under one management. The National Association of Automobile Manufacturers spared no expense to make the 1913 shows the best yet, and in the Grand Central Palace show so elaborate were the decorations that the walls were covered with specially painted woodland scenery

Practically all the cars exhibited this year have two distinct improvements—motor starters and electric lights. The self starters are of several kinds, ranging from a coiled spring to acetylene gas, which is pumped into the cylinders and exploded by a spark, but the most popular device of this kind at present is the electric, in which a small electric motor placed beside the flywheel carries a pinion that can be meshed at will with teeth cut on the periphery of the wheel. Current from the 6-volt or higher storage batteries, drawn at the rate of 150 amperes or more for a few seconds, causes the motor to make the few revolutions sometimes necessary to start it. This current is restored to the batteries later by the motor acting as a dynamo, or by a separate charging dynamo used on some systems.

By far the neatest electric self-starter consists of an 8-pole ring-armature motor, the armature of which forms the flywheel of the gasoline engine Thus the hundred pounds or more of extra dead weight is eliminated. One starter has the electric motor mounted in front of the radiator and driving the crankshaft through a worm gear Another consists of an opposed cylinder air motor similarly situated. But as a rule the mechanism is concealed, and the only indication that a car is so equipped is a cap on the end of the crankshaft. This can be unscrewed and a starting crank applied if for any reason the self-starter fails.

Given a charging dynamo, the installation of an electric lighting system is an easy matter Electric headlights are more powerful than acetylene lamps, besides giving a perfectly steady and white light. The tungsten filament lamps are also economical of current, which is generally supplied by a 6-volt storage battery The Westinghouse system makes use of the frame of the car in place of a return wire, thus cutting in half the amount of wiring and simplifying greatly the detection of any trouble. Closed cars are fitted with dome lights in the ceiling, as well as with interior antique lanterns in some instances. Many have dashboard lights to illumine the various meters and gages at will, and in one instance the push switches for all lights were arranged on a panel just below the steering wheel. In the majority of cars, the usual side lamps are dispensed with and two bull's eye electric lights are placed in the dashboard.

The upholstery on the 1913 cars is better than ever before, the cushions are thicker, and everything has been done for comfort. On some high-priced cars cushions 10 and even 14 inches thick are used.

Shock absorbers are fitted to a few machines, but they are not part of the regular equipment as a rule. There have been one or two new types of springs introduced, but no maker has adopted a substitute for springs such as the Cox pneumatic cushion described in these columns some time ago.

Several makers have returned to the use of wire wheels, which, it will be recalled, is the type that was used on the first automobiles. An English wire wheel that has met with success in Great Britain has of late been applied to a number of American cars. Wire wheels are rather more elastic than wood wheels, besides offering the advantage that they can be readily repaired, even when badly damaged.

Rounded or pointed radiators have been adopted by a few more concerns on their 1913 product. They give a car a "speedy" appearance besides being stronger and having more radiating surface.

As regards engines, there were practically no novelties. Two or three firms exhibited cars equipped with the Knight sleeve-valve motor, and a sectional engine was shown in operation. Only one car still uses an air-cooled motor The vertically flanged cylinders are jacketed and air is drawn down through the flanges by means of fan blades in the flywheel. Another car is fitted with a rotary valve motor such as has been previously described in our columns in connection with aeronautic engines. The 6-cylinder engine, though not quite as prominent as it was last year perhaps, is nevertheless manufactured by most of the leading automobile builders, and can be had at a little higher price than the four For car prices we refer our readers to the table on page 44 in our recent automobile number of January 11th.

Electric pleasure vehicles were crowded out of the Madison Square Garden show this year completely, and only a few makes were shown at the Grand Central Palace Noteworthy among these was a brougham which climbed Mt. Wilson in California, a height of over a mile above the sea This machine is equipped with a lead battery and covers 75 miles on a charge on good roads. In the commercial vehicle shows to be held in the Garden and Palace from the 21st to the 26th inst., doubtless electric automobiles will figure more prominently

The Transportation of Live Fish in a Frozen Condition

FISHES belong to the class of animals that have variable body temperature, depending on the temperature of their environment. In extreme cold they assume a rigid condition, in which all of the vital functions are suspended, while life still remains present. During several months of each year some of the great rivers of Siberia are frozen solid to the bottom but many of the fishes imprisoned in the ice retain their vitality, and resume their active life when the ice melts in spring.

This fact has suggested experiments in the freezing of live fish for transportation, which are discussed in the *Fischerei Zeitung* Many years ago the celebrated physicist Pictet of Geneva put fresh water fishes into a tub of water, which he kept liquid at the freezing point for 24 hours, and then allowed to freeze slowly into a solid block of ice, which afterward was cooled gradually to — 20 deg. Cent. (—4 deg. Fahr) When the ice was melted, a month or even two months afterward, the fishes began to swim as briskly as they did before freezing, and showed no symptom of ill health.

Similar experiments have recently been made in France. The fishes are placed in water which is kept near the freezing point for a few hours, then at the freezing point for 15 to 18 hours, and finally frozen by immersing the vessel into a freezing mixture, producing a cake of ice a few inches thick, in which the frozen fishes are imbedded. This cake is wrapped in cloth and surrounded with a heat insulating packing to prevent melting during transportation. It is necessary to thaw the ice very slowly and to keep the water near the freezing point for several hours, in order to preserve the life of the fishes. Even those which do not survive are in a perfect state of preservation.

The Death of Dr. Thaddeus S. C. Lowe

AT the ripe age of eighty Dr Thaddeus S C. Lowe died on January 16th at Pasadena, Cal. He was a type of brilliant all around inventor and engineer that is fast disappearing. He worked in many fields, usually with conspicuous success. Probably he is best known for his remarkable improvements in water gas apparatus which were adopted generally So, too, his inventions relating to artificial refrigeration, metallurgical furnaces and coke ovens earned for him fame and fortune. Even aeronautics received his attention; for he was chief balloonist of the Union army during the civil war. Indeed, his early exploits in ballooning were remarkable. He rose to a height of 23,000 feet in 1858 and in 1861 he drifted 900 miles in nine hours The observatory at Mount Lowe in California was built by him.

How to Remove Old Wall Paper

A GOOD way to remove old wall paper is to use the following solution: A thick pasty solution should be made by adding flour and a few spoons of salt into boiling water. After this is made add a few ounces of acetic acid, which may be purchased at any drug store. This pasty mixture should be applied with a brush to the old wall paper [illegible] few minutes the old paper [illegible] [illegible]

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Attitude of Railroads to the Automatic Stop

To the Editor of the SCIENTIFIC AMERICAN

Your editorial on "The Automatic Railroad Stop" in the issue of December 28th last, as well as the several articles which you have recently published on automatic train control, have proved of much interest to those concerned in railway operation.

It is a sad commentary on the intelligence of railway managers when a large reward is offered through a displayed paid advertisement, coupled with conditions that savor of an attempt to make the public believe that from a high motive and in the interest of the traveler, the railroad is seeking safety devices which have never been heard of before, as well as to make it appear that to railroad managers such devices are an unknown quantity, and that a reward advertising the road is the only means necessary to encourage the invention of some device to overcome the "human equation."

But the facts remain, that for a long period of years such devices have been exploited, tested, and published, and those interested have been afforded opportunities for investigation, if they desired to do so. It is well known that automatic stops were in service on the Chicago elevated roads before the Boston elevated road was built or even contemplated, automatic stops were used in connection with interlocking and yard signals on the Boston, Revere Beach & Lynn Railroad in 1891, the intramural railway at the Chicago World's Fair in 1893 was equipped with a complete system of automatic block signals and stops, and attracted much attention from railroad managers. In the winter of 1893-4 the Chicago South Side elevated road installed station protection, consisting of signals and automatic stops, and in the winter of 1894-5 the Metropolitan West Side (elevated) road of Chicago installed block signals and automatic stops.

That the subject is not a new one, we refer to the SCIENTIFIC AMERICAN, which nearly twenty-three years ago—to be exact, on May 10th, 1890—on their front page gave illustrations and described a system as follows

"The Rowell Automatic Railway Safety Stop"

"We had the pleasure of attending a thorough test made of the Rowell safety stop given at Neponsett, Mass., on April 9th

"A special train of four cars was run from the Old Colony Depot in Boston, and a large number of prominent railroad officials were among the guests. Several tests were made, all of which were successful and conclusively showed that with the safety stop in position, it was possible to stop a train running at the rate of 40 miles an hour in less than 500 feet.

"In the first test the train was stopped in 380 feet, second test was made in 390 feet, and in the third test, made with all the party on board, the train was stopped within 370 feet, and the shock, though plainly felt when the brakes were applied, did not inconvenience anyone All present pronounced it an unqualified success, and tests were also made with the portable form of safety stop, which enables the conductor to absolutely prevent his train from being run into from either direction

"Safety Stop.—The effectiveness of this device does not depend upon the speed of the train. It stops the train without the aid or knowledge of the engineer, who can by this absolute protection maintain a high rate of speed on the darkest night, when it is impossible to see the signals.

"B C Rowell, the inventor, is an old railroad man, having been for many years brakeman and conductor, and thus has a practical knowledge of exactly what is of use in an emergency

"This safety stop, while absolute in the protection afforded, is comparatively inexpensive, certain in action, and easily applied. Its general adoption by the roads would greatly lessen the danger of travel and entirely do away with nine tenths of the accidents that are so costly to the companies."

On April 3rd, 1909—nineteen years later—the SCIENTIFIC AMERICAN SUPPLEMENT had an illustrated article on the front page, written by Frank G. Perkins, describing the same invention, further developed, which was installed on the main line of the Chicago, Burlington & Quincy Railroad, and under Government test, as a complete system of automatic train control to meet all operating conditions.

It is not necessary to enumerate the individual tests under the supervision of the Block Signal and Train Control Board during their existence and covered in their printed reports of 1908, 1909, 1910, and 1911, which reports were largely distributed, as many as 5,000 copies of their second annual report (November, 1909) and [illegible] copies of their third annual report (November, 1910) having been distributed from their secretary's office.

The Board was abolished [illegible] under a joint resolution of Congress approved June 30th, 1906, "to enable the Interstate Commerce Commission to investigate in regard to the use and necessity for block-signal systems and appliances for the automatic control of railway trains, including experimental tests, at the discretion of the Commission, of such of said signal systems and appliances only as may be furnished in connection with such investigation free of cost to the Government in accordance with the provisions of the joint resolution approved June 30th, 1906." Owing to the large number of devices submitted, the Board informed the inventors that "their ideas cannot be considered unless presented in the form of plans and specifications showing in detail a practicable device designed to perform a useful function, and clearly describing the manner in which that function is proposed to be performed" Only such devices were approved as were considered as possessing merit to warrant the Board in offering to test satisfactory installations.

According to the Board's fourth annual report (December, 1911) the last report issued, a total of 21 automatic train control devices were upon examination considered to possess sufficient merit to warrant the Board to test satisfactory installations. Illustrations of these devices with full description and record of tests under all weather conditions can be found in the Board's reports.

In the fourth annual report the Board states

"The information obtained from tests, together with knowledge of the general state of development of the art of automatic train control, leads the Board to conclude that there are several types of apparatus and methods of application which, if put into use by the railroads, would quickly develop to a degree of efficiency adequate to meet all reasonable demands. Such devices properly installed and maintained would add materially to safety in the operation of trains. In many situations, under conditions existing in this country, the Board is convinced that the use of automatic train stops is necessary to the safe operation of trains

"Further, the Board has no hesitancy in saying that had the railroads directed the same effort toward the development of automatic train-control apparatus that has been devoted to the development of interlocking and block-signaling apparatus, we should now have adequate installations of automatic train-control devices which would permit an engineman to handle his train without interference as long as he did it properly, but would intervene to stop his train if he disregarded a stop signal or ran at excessive speed where speed restriction was prescribed."

To ignore these reports because the Board have not designated some one particular device is unjust, as the province of the Board was to report on the good and bad features of each device under test. The Board in their fourth annual report state

"This Board can do no more than render an opinion concerning the devices examined, and when favorable opinions are rendered, it has only the effect to enable the proprietor of the approved device to advertise more extensively"

The statement that "when favorable opinions are rendered, it has only the effect to enable the proprietor of the approved device to advertise more extensively," is not in conformity with the scientific treatment of an important subject by a body of experts or to be used to cloud their findings. The installations being made at the owner's expense, should not be deprived of a favorable report if the device merited one, as well as all other advantages resulting therefrom.

The railroads have the benefit of five years of Government investigation at the expense of the proprietors, the experimental stage has been passed. There would be no difficulty, if there was a disposition in finding appliances that will meet all conditions of automatic train control Many of the objections raised are theoretical from lack of practical experience, but in justice to the railroads, and possibly overcoming one of the most serious objections on their part, they should be protected as outlined in the third annual report of the Block Signal and Train Control Board, viz.

"One objection which has been urged against the introduction of new safety appliances is that after a partial introduction of them, a liability for damages might exist in connection with accidents on part of a railroad not yet equipped with them. It has been suggested that such a situation might be met and the objection entirely overcome, so that no injustice would be done to the railroad, by a simple enactment that the partial application of such devices should not of itself create any legal obligation to equip the entire line in the same manner, that such fact should not be admitted as evidence in any court of an obligation to equip any part of a road not already equipped, and that any case of damage occurring on any portion of a road not equipped should be determined without consideration of the installation on another part of the road."

Protection should be given the railroads when they equip a portion of their road for experimental purposes or by compulsion Such enactment would undoubtedly remove much of the prejudice now existing, and would tend to promote the development of all kinds of safety appliances. GEORGE W RISTINE

Chicago, Ill.

Turning Effects of Rudders

To the Editor of the SCIENTIFIC AMERICAN

My attention was drawn to a correspondence in your issue of Jnly 13th last, by Mr A C Lawrence of Toronto, a copy of which I beg to inclose and which I think much to the point Why, indeed, should autos be steered from forward, making every turn with a surprising neatness, and a ship twenty times as long as an auto be steered like the wheelbarrow, from behind?

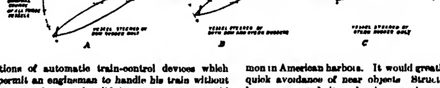
I hereby beg to inclose a set of drawings which, if you compare them with Mr Lawrence's letter, will express to you my opinion on the matter

In the drawings of three ships, Fig C corresponds with Mr Lawrence's explanation of the stern rudder action, and Fig A with his explanation of the bow rudder action Fig B shows the movement of a ship under the combined control of both bow and stern rudders I send you, also, the necessary details for a bow or forward rudder such as I have tried, for twelve years, to make the people on this side of the Atlantic to see the use of

If you, Mr Editor, would convey a great boon to seafaring men all over the world, publish the inclosed drawings with such editorial remarks as will seem proper to you A H KIEHL.

Voorburg, near The Hague

[Our correspondent sends us also sketches of his design for a balanced bow rudder, carried in the forefoot between the stempost and keel and an inner 'cage' stempost The bow rudder is in use on special types of vessels, particularly on ferryboats, the practice being common in American harbors. It would greatly facilitate the quick avoidance of near objects Structural objections have prevented its adoption on large ocean steam ships.—EDITOR.]



A B C

Free Will Versus Determinism

To the Editor of the SCIENTIFIC AMERICAN

I was glad to see Mr Agnew's able letter in your issue of December 21st, 1912, supporting man's free will against the shallow, fatalistic theory of the determinists.

No one with any pretensions to enlightenment upholds the latter nowadays. Instead of determinism being the "only thoroughly scientific standpoint," it is merely a relic of the materialistic thought of the 19th century

Man is not a mechanical automaton, but a spiritual being—a living soul—inhabiting a physical body for temporary purposes, and when he realizes this, and in right of this, he is able to rise above all external forces and limitations.

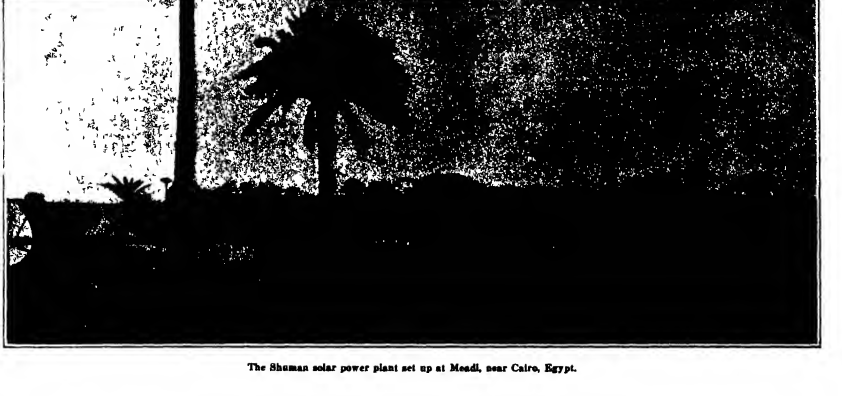
All of the great thinkers are in favor of free will under certain restrictions, of course, the greatest of all, Kant for instance, with his "You can because you ought." Capacity goes with obligation Freedom is the fundamental presupposition of all morality

Some of the leaders of the materialistic theory have lately acknowledged that behind the laws of nature there must be a Law-giver, thus practically giving their whole case away

Should any of our readers be still in doubt on the point, let them read Bergson's "Time and Free Will," where the problem is thoroughly thrashed out Indeed the controversy is a futile one, arising from a mistaken conception of terms and a lax way of thinking about time and space—a desire to endow duration with the attributes of extensity As Bergson puts it "Every demand for explanation in regard to freedom comes back, without our suspecting it, to the following question Can time be adequately represented by space? To which we answer, Yes, if you are dealing with time flown, No, if you speak of time flowing Now the free act takes place in time which is flowing, and not in time which has already flown Freedom is therefore a fact and among the facts which we observe there is none clearer". A. K VENNING

Los Angeles, Cal.

[The Editor can publish no more letters on this subject.]



The Shuman solar power plant set up at Meadi, near Cairo, Egypt.

An Egyptian Solar Power Plant

Putting the Sun to Work

IN the SCIENTIFIC AMERICAN of September 30th, 1911, we described and illustrated the solar power plant which Mr Frank Shuman of Philadelphia designed for eventual use in Egypt The plant was actually transported to Egypt and there set up but in slightly modified form

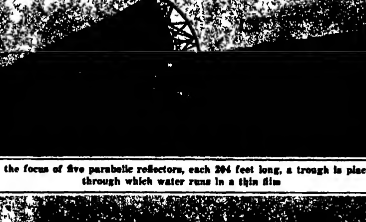
It will be remembered that instead of employing lenses or mirrors as Ericsson did, to concentrate upon a small boiler the heat rays of the sun, Mr Shuman utilizes a heat absorber which may be likened to a greenhouse In the Philadelphia plant a thin film of water flowed over the bottom of a trough inclosed by two layers of glass between which was an airspace Plane mirrors at each side of the trough reflected additional rays of the sun upon the water The trough was carefully insulated In this absorber the water was raised to a temperature very nearly that of the boiling point of water To utilize the heat energy thus stored up, Mr Shuman had to devise a special low pressure reciprocating steam engine The heated water which is utilized was returned to the absorber after having performed its duty

In the Egyptian plant Mr Shuman used parabolic instead of plane mirrors, with better results All told five absorbers and reflectors were installed at Meadi, a suburb of Cairo Each reflector parabolic in form was 204 feet long and in its focus was the trough Silvered glass mirrors lined the sides of the reflector and constantly faced the sun The troughs of all five reflectors were rectangular in section 14 inches wide with sides only three inches apart In order to increase the heat absorbing efficiency the troughs were painted black

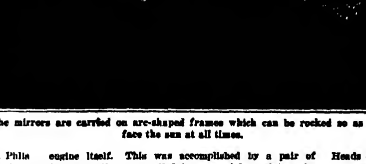
The glass plates and insulating material employed in the absorber of the Philadelphia plant have been discarded The steam is collected at one end in a pipe four inches in diameter and the water flows in at the other end. Between the water and steam ends there is a drop of six inches in the entire length of 204 feet of the absorber The engine presumably is the same as that which was used in Philadelphia It works at somewhat below atmospheric pressure or at a pressure corresponding with a temperature of about 200 deg Fahr Connected with the engine is a condenser of the ordinary type and auxiliaries, such as may be found in many a condensing plant The vacuum to operate the condenser is obtained before starting by means of a gasoline-driven air pump. After the plant is in full operation the gasoline engine is cut out

In order that the reflectors may be cleaned—an operation more or less frequently necessary because of the dust prevalent in Egypt—the mirror frames can be tilted and the mirrors washed with a hose.

In the Philadelphia plant the troughs were mounted on supports which elevated them some thirty inches above the ground and which permitted them to be inclined perpendicularly to the sun at the meridian These adjustments of the installation were made about once in three weeks. In the Egyptian plant the reflectors were made to follow the sun automatically through out the day by gearing them up with the main steam engine itself. This was accomplished by a pair of friction pulleys controlled by a special regulator, the chief element of which was a thermostat



In the focus of five parabolic reflectors, each 204 feet long, a trough is placed through which water runs in a thin film



The mirrors are carried on arc-shaped frames which can be rocked so as to face the sun at all times.

Instead of twenty-six rows of absorbers the number used in the Philadelphia plant, five only were installed in Egypt, so placed that one could not shade the other

The Egyptian plant was started with zinc boilers or absorbers. A temperature so near the boiling point of zinc was reached that the troughs finally hung down limply like wet rags. Although hard solder was employed, it melted down at the top of the absorbing troughs. For all that Mr Shuman assures us, the zinc absorbers lasted long enough to prove that the plant might be eventually successful He claims to have found that water can be pumped for less than one third of the price which would have to be paid if coal were burned. A set of steel troughs is now in course of construction, which will probably be installed in about four months. By welding the joints with the oxy acetylene flame he hopes that they will be absolutely indestructible.

Mr Shuman states that the steam pipes are so long that the steam becomes highly super heated where it issues near the engine

Up to date something like one hundred thousand dollars have been spent on these experiments.

The Art of Primitive Man

OUR far-off ancestors of the stone age, the rude and primitive men of the quaternary epoch to whom the use of fire was unknown and whose arms consisted of a few roughly hewn pieces of flint, nevertheless appear to have had some rudimentary artistic ideas. In fact, sculptures dating from 200,000 years were shown at the last congress of prehistoric archaeology and anthropology, which recently held its fourteenth meeting at Geneva This subject was treated by a French scientist, M Dharvent, of Bethune, and he showed specimens of sculptured silex representing animal figures which were found in the alluvial strata of the quaternary epoch among arms and instruments of the same period. M Dharvent made an interesting communication to the congress about these first trials at sculpture which have yet been discovered. Natural stones were used which had some resemblance to animal figures, and these were afterward retouched so as to finish the work One of the striking specimens is the head of a monkey, in which the features are very clearly seen, especially when viewed in profile, as the photographs show We hope to be able to obtain views of these specimens in the near future. Heads of other animals and birds are also among the most remarkable specimens. Authorities on prehistoric questions consider that the strata bearing these finds date from about 220,000 years.

A Massive Rudder.—What is believed to be the biggest rudder ever made in two pieces, the top portion weighing 27 tons and the bottom portion 15 tons, has been built for the new Allan liner "Calgarian," now under construction at Glasgow. The total height of the rudder is 26 feet 6 inches and the extreme width is 21 feet.

The exhaust machine and whistle is driven by a motor. One machine is used for the train and one for the automobile.

"The Whip" and Its Mechanism

A Ponderous Melodrama with Dogs, Horses, Automobiles and Trains that Move and are Wrecked

Back of the car, showing motors for driving false wheels, raising and rotating the panorama Note the steam exhaust

"THE DRURY LANE," with its massive melodramas, is a household word among all English-speaking people. The stage of this theater, with its huge electrically-driven bridges, lends itself to effects requiring ponderous machinery and accessories. One of the best plays ever put on at the famous London playhouse was "The Whip," which ran continuously for two years, delighting hundreds of thousands. This production has now been translated bodily to the Manhattan Opera House, New York There are four acts and thirteen scenes in the play but we need concern ourselves only with two, which are interesting from a mechanical point of view These are the famous rail road wreck and the horse race, both of which are now illustrated for the first time by authoritative photographs and drawings.

The entire play is written around "The Whip," a race horse of phenomenal speed, on which large sums of money are wagered. This forms the motive which leads to the perpetration of an atrocious crime The race is supposed to be run at New market for the '2,000 guineas' stakes. This necessitates the transportation by rail of "The Whip," with her trainer and jockey, in a box car, such as we so often see attached to English local trains. One of the prettiest scenes is that where the race horse is led to the Falconhurst Station and loaded on the waiting box car Presently you hear the sound of the whistle, the friction of revolving wheels and the exhaust of steam, and a regular English coach, with four compartments, comes slowly down the track and picks up the box car The signal to start is given the wheels revolve, the country flashes past. After a few minutes a tunnel is reached, and the audience can even see the bricks as the train rushes through it This is the opportunity which the villain has been waiting for, the death of the mare must be accomplished at all hazards. He opens the door of his compartment crawls along the running board throws off the tail light on the box car and uncouples the car, leaving it standing on the track, while the train passes out of view of the passengers.

The box car containing "The Whip" leaving Falconhurst Station

The heroine finally succeeds in reaching the tunnel by automobile just in time to release the horse and the jockey the trainer having been detained by a misadventure in Madam Tussaud's "Chamber of Horrors." They make frantic efforts to flag the express, which is heard approaching at a rapid rate of speed The engineer fails to stop in time and the locomotive strikes the box car, which is converted into kindling wood There are many passengers on the express train killed and wounded The steam and fire effect at the locomotive is very realistic.

Now, let us explain how it is accomplished. The coach is operated by about eighteen men, who control the various switches and force the car back and forth attend to the exhaust to the whistle and to the management of the panoramas Only three men can be shown at the back of the coach, otherwise the machinery would be obscured There is a set of false wheels in front which do not run on the track, but mask the actual wheels. An electric motor serves to operate them motion being transmitted from the rear of the coach to the false wheels by the aid of shafts. There is another motor which raises the small panorama at the back of the coach which serves to simulate the bricks in the tunnel A third motor is for the purpose of driving this panorama widthwise The electric lights in the coach go out for an instant when the panorama is raised The effect of the exhaust steam from the locomotive is obtained by using a jet of steam illuminated from a spot light and working intermittently A simple exhaust throttle valve controls this jet It is started by hand and when the speed of the train is to be increased a motor is thrown in. The whistle is carried on the same framework and is blown at the time of starting and stopping A simi

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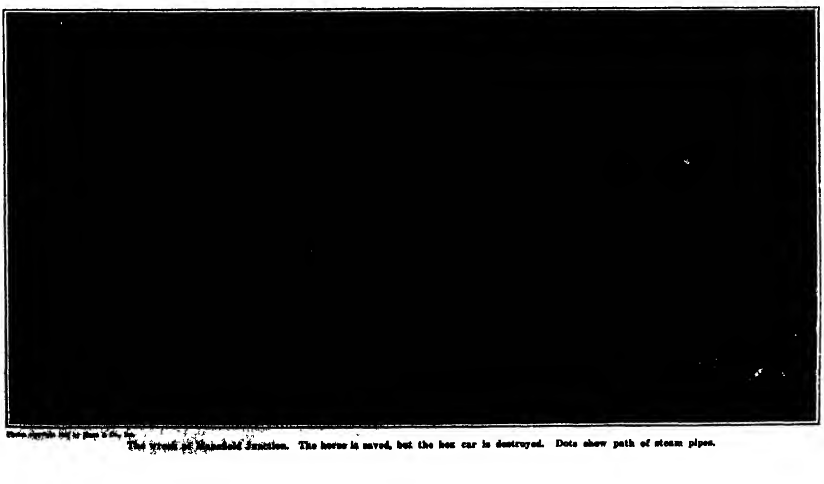


[illegible]

The wreck at [illegible] Junction. The horse is saved, but the box car is destroyed. Dots show path of steam pipes.

Climbing a Magnetically Supported Chain

By Our Berlin Correspondent

AN interesting experiment was recently made at the works of one of the large German manufacturing firms with one of their lifting magnets. A chain secured to the ground at one end and carrying an iron ball at its free end was raised to a vertical position by the approach of the lifting magnet suspended from a crane.

As seen from the accompanying photograph the chain throughout its length remained in vertical position below the magnet. A grown up workman climbed up the chain without disturbing its rigidity. The chain seemed to float in air. The magnetic pull on the ball was greater than the gravitational pull on the man.

This remarkable experiment shows the enormous power of attraction exerted by industrial lifting magnets as used on an ever increasing scale in iron and steel works for the transport of iron materials of every description. In no other field of metallurgy are the economical advantages of transport by electricity so conspicuous as in connection with the use of lifting magnets, which enable the operator to seize the iron material at any point desired, conveying it to any other point within the range controlled by the crane. Incidentally, it should be noted that the use of lifting magnets eliminates much of the risk of accidents formerly connected with manual transport and the use of hand operated cranes.

Cranes with lifting magnets are of course used on a large scale also in connection with the loading and unloading of railway wagons with all sorts of iron material.

His Mattress a Life Raft

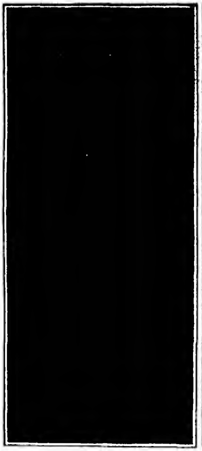
A RETIRED lieutenant of the U. S. Revenue Cutter Service recently hit upon the idea of making a life raft which may serve also as a mattress for use in bunks and beds on shipboard, as well as in houses and hotels along waterways where floods and overflows may take place suddenly and endanger the lives of the occupants. The mattress is constructed of resilient material provided with the usual ticking and surrounded with a waterproof and substantially airtight casing. This is further provided with an outer waterproof envelope to act as a protecting sheath for the inner casing. In place of felt the inventor prefers to use a resilient filler which is in itself a water-resisting material, so as to prevent the mattress from becoming watersoaked, in case the cover becomes ruptured or torn. In order to prevent the mattress from sagging in the center or bending under the great tortional stresses to which it may be subjected by the waves, a rigid marginal stiffening frame is provided. Lashings are also attached to each corner of the mattress, so that when it is used as a life raft they may be tied diagonally across the mattress to strengthen the frame and also to provide means for securing persons or articles to the float. In addition to this, loops and handholds are provided along the margin of the mattress. One of our photographs shows the mattress in use as a raft. In order to fairly test its efficiency, a mattress only 24 inches wide and of a size to fit the army transport stateroom bunk was punctured with seventeen holes and then heavily loaded with lead and floated in the water. It remained in the water for thirteen days, without showing any tendency to sink. The accompanying photograph shows the appearance of the mattress after this treatment.

The Edison Electric Safety Lamp

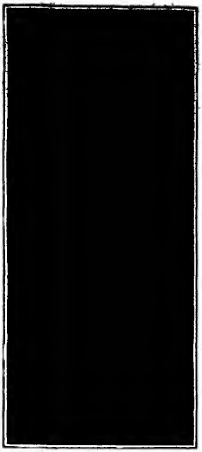
ON the evening of January 23rd, at the American Museum of Safety, New York, the Rathenau Medal granted by the Allgemeine Electricitaets Gesellschaft, Berlin, for the best device or process in the electrical industry for safeguarding industrial life and health will be awarded to Thomas A. Edison, for his safety miner's lamp. The desirability of using electric lamps in place of oil lamps, even those protected with a "Davy" wire screen, is strongly felt in these days. What is needed in mines is a positive light which does not depend upon the uncertain quantity of oxygen contained in the surrounding atmosphere, but is absolutely self-contained. Further, even a Davy lamp is not perfectly safe if through careless handling it is broken.

Mr. Edison's miner's lamp is operated from a storage battery of large capacity and very light weight, which may readily be carried upon the back of the miner in the manner indicated in the accompanying engraving. The nickel oxide battery is particularly adapted for such work where it is liable to be roughly handled, and subjected to such treatment as would put the ordinary lead storage battery out of commission in a short time. The battery is completely sealed and locked so that the miner cannot tamper with it, and it has only one miniature outlet for the escape of harmless gases when it is being charged. There is no danger of escape of the electrolyte even if the cell is inverted, because the outlet for the gas is at one end of the steel tube which extends downward from the top of the container to within a half inch of the top of the electrolyte, and is so formed as to preclude the escape of the solution even when the cell is violently shaken. The gases that pass off do not carry with them any substance to corrode the steel parts used in the construction of the lamp or the case of the battery or the clothing of the miner. No injury is done if the cell is overcharged and no harm comes to the plates if left semi-charged or discharged for an indefinite period. The cell may even be charged backward without serious consequences, although of course the battery will give no service unless charged in the proper direction. The only attention required aside from charging the battery is to replenish it with distilled water from time to time and renew the electrolyte after about nine or ten months of continuous daily service.

The flexible cord connector between the battery and the lamp is provided with a terminal which when shoved into the socket of the battery case becomes locked therein and cannot be removed until the padlock on the side of the case has been removed and the lock bar withdrawn. And so it is impossible for the miner to cause a spark by disconnecting his wires in the mine. To protect the conductor it is incased in flexible steel armor so as to prevent a sharp bend. A tungsten lamp is used with a parabolic reflector and a heavy lens to distribute the light over the proper area, and the lamp is provided with a hook that may be fitted to the regulation miner's cap. This lamp is the result of several years of persistent work on the part of Thomas A. Edison.



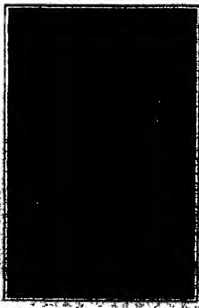
Climbing a magnetically supported chain.



How the electric safety lamp is worn by a miner.

The safety lamp and battery with battery lock bar removed.

Using the mattress as a life raft.



Mattress after floating for 13 days.

The Life of London

FROM the London County Council's statistical abstract for 1911-12 some conception may be formed of the activities of that portion of Greater London which is confined to the county of London. It should be understood that Greater London, with an approximate population of 7,250,000, overlaps the county of London and passes into the counties of Middlesex, Herts, Essex, Kent and Surrey. Some of the figures given in the London County Council's abstract appear below.

Population, 4,522,961, debt, $558,858,960, weddings a year, 40,201, births, 112,795, deaths, 61,909, deaths by accident, 1,846, fires, 3,208, paupers, 140,560, police, 17,293, soldiers, 10,058, postal employees, 49,960; firemen, 1,365, motor cars, 8,318, postoffices, 1,061, letters delivered, 805,900,000; post-cards, 199,800,000, telegrams, 25,662,000.

The imports into London constitute 33.8 per cent of the total imports into the United Kingdom, and more than half the income tax on salaries is paid by London.

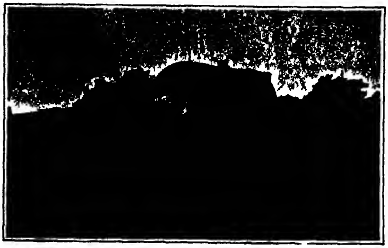
Motor Street Sprinklers in Europe

REGARDING the use of special power wagon outfits for municipal service, we may mention that the city of Paris is now employing a number of automobile sprinklers and sweepers, these being made by several different firms. It is stated that the city of Berlin is to purchase 16 combined sprinklers and sweepers, representing the sum of $40,000. As to the fire department work, the Berlin department now has 60 [illegible] in service, and [illegible] like those of Paris [illegible] are [illegible] by storage batteries. The [illegible] [illegible] [illegible] [illegible] is following [illegible] [illegible] [illegible] [illegible] [illegible] first of these [illegible] [illegible] and [illegible] will [illegible] made.

READERS are invited to contribute to this department photographs of novel and curious objects, unique occurrences, and ingenious contrivances. Such as are available will be paid for promptly.

Motor-pumped Street Sprinkler

IN order to provide a wider distribution of water from a street sprinkler a machine has been built which is propelled by a gasoline engine, and which has a double-acting water pump driven by the motor. With this combination the water may be spread over streets 70 to 80 feet wide on a single run. The operation of the pump may be governed to control the area to be sprinkled and to insure a uniform distribution of water. One of the objections to the usual type of horse-drawn sprinklers is the fact that the nozzles are placed at the rear of the vehicle, and do not prevent the raising of dust by the wheels and horses. In order that the motor truck may not cause the very evil it is designed to cure the spray nozzles are placed about a foot in advance and on either side of the motor hood. Thus the street is wet down in advance of the wheels and no dust is raised. The sprinkler shown in the engraving has a tank 4½ feet in diameter with a capacity of 1,400 gallons, which is mounted in a cradle and guyed with cross braces upon a 6½ ton chassis. A curious phenomenon may be seen in the illustration. The pulsation of the double action pump may be clearly observed in the spray of water thrown off from the nozzles.



Note the spurting spray caused by the pulsations of the pump

A Granite Statue of Electricity

THE Union Station at Washington is ornamented by six large statues ranging at intervals above the main entrance and looking out over the plaza that looks off to the Capitol building only a short distance. One of the statues representing Electricity is shown. It is the work of St. Gaudens and presents a majestic figure carved from a solid block of granite. The statues are probably the largest ever cut in a solid piece from granite and while they appeared colossal when on the ground as will be appreciated from the comparison with the two men standing alongside in the picture, they are well proportioned to the building when elevated to the high position they now occupy. The hoisting of the statues to a considerable height was no mean engineering proposition and was accomplished by suitable derricks and hoisting cables. To facilitate the operation the statues were supplied with a composite corset of heavy timbers and steel wire to receive the hoisting cables without injuring the carvings of the beautiful figures.

Raising the statue of "Electricity" at the Union Station, Washington

Legs of Max Unger's gigantic Frithjof monument

New Sanitary Drinking Fountain

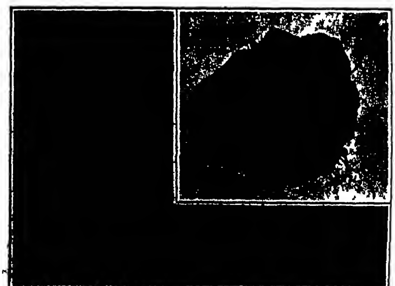
A NEW type of sanitary drinking fountain has been erected in Lafayette Square, Washington, D. C. This square lies immediately north of the Executive Mansion and almost in the shadow of the Cosmos Club of Scientists and the staid aristocratic St. John's Church which most visitors to Washington remember. The design of the fountain is rather ornamental, but unobtrusive. The fountain has a large basin into which the overflow from the nozzle cups discharges. The nozzle cups are at the outer ends of flexible tubes whose inner ends connect with the water supply, and the water flows up freely through an opening in the center of a dome-like plate rising almost to the top of the cup, so the user can drink without touching the metallic parts of the cup, out of which the water constantly flows in a [illegible] stream. The cups are shackled by individual chains to an upper portion of the foundation, so they cannot fall outside the basin when released by the drinker. [illegible] the cups when not in use discharge into the basin [illegible] the [illegible].

The "nozzle cup" fountain.

"Magnet Bill" saving automobile tires.

The Curious Lung Fish

A [illegible] has been [illegible] at the Museum of Natural History, New York that has shattered all popular conceptions of what a fish ought to be, as it possesses the surprising power of living six months, or possibly a year, out of water. Instead of a miniature aquarium or some sort of a box filled with the customary amount of water for its long sea voyage of thousands of miles the lung fish was transported in a block of dry earth which had only a funnel-like opening to admit air for the fish's breathing. This pit led into a tube of hardened slime which went into the fish's mouth and conducted the air directly into the lung of the fish. The lung fish, as it is called, breathes by means of gills when in water but with a lung during the summer drought, inhaling and exhaling air as though it were a land living animal. The fish came from the Gambian region of Africa coiled up in a kind of cocoon or capsule deeply sunken in a large clod of earth. To liberate the fish it was necessary to cut the hard earth away carefully from the papery cocoon. Then the cocoon was placed in tepid water to soften the shell which was formed by a mucous secretion on the surface of the fish's body. Within a few minutes the cocoon showed movements and shortly the fish emerged from it. The lung fish has been placed on exhibition in an aquarium in the Hall of Fossil Fishes. Prof. Bashford Dean states that it had been placed there because it is at home scientifically speaking among fishes which lived millions of years ago and whose race is almost extinct. A more complete description of this curious creature may be found in the current SUPPLEMENT.



African "lung fish" and a lump of mud containing the capsule in which it lives, breathing air during a drought.

A Gigantic Monument

THE German Emperor's passion for monuments expressed in a series of rather inartistic statues which have been mounted in the Siegesallee of Berlin to the intense amusement and disgust of all the comic weeklies in Germany is responsible for Max Unger's Frithjof monument. Next summer this colossal piece of work the mere legs of which are presented in the annexed illustration from *Moderne Kunst* will be unveiled in Norway to commemorate the twenty-fifth visit of the Emperor to that favored Scandinavian country. Naturally the monument is a gift from the Emperor and he himself will attend to the unveiling. The imposing legs herewith reproduced attain the majestic height of 23 feet. It goes almost without saying that the monument had to be made in small pieces. The statue will be erected on a peninsula opposite Balholm where according to tradition the graves of Ingeborg and Frithjof are to be found.

Saving Tires With a Magnet

HE doesn't look like a very important part of a big automobile factory organization, this tall, broad-shouldered, stooped and somewhat grizzled man who may be seen rain or shine, summer or winter, walking slowly about the plant, eyes almost constantly cast earthward, but he is an important item in the modern method of factory operation. Though his wage is that of the average workman, "Magnet Bill," as the grizzled man is known, is worth a good deal to the company by which he is employed. Bill gets his nickname from the fact that his tools consist solely of one tin bucket of the 10 or 12-quart variety and a big steel magnet strapped to the end of a short handle to allow for ease in operation. And his work is very important even though it looks simple to the passer-by, for it is Bill's duty to save automobile tires by removing from the roadway every nail and bit of iron or piece of steel that might cause a puncture. When it is known that 40,000 cars are run over this course to and from the places where they are tested, and scores of visitors' cars, office machines and delivery trucks use the thoroughfare daily, the value of Magnet Bill is at once apparent.

The Mercy of Steel and the Menace of Wood

A Study of Some Recent Railroad Accidents

WHEN the "Titanic" brushed elbows with an iceberg and tore open two hundred feet of her length, the public wondered at the frightful character of the injury. But the engineer did not wonder—he knew perfectly well, although he had temporarily forgotten it, that the one million foot-tons of energy in that onrushing ship was sufficient, had the obstruction been solid rock instead of crumbling ice, to have opened up the whole length of the ship, if the pressure of her helm had sufficed to hold her a little longer against the side of the iceberg. In multiplying length and breadth, tonnage and speed, naval architects had overlooked the fact that it was incumbent upon them to introduce under-water constructions which would limit the damage due to the enormous energy of the giant vessels of the twentieth century.

What is true of the sea is true also on the land. There has been an astonishing growth in the length, size and weight of the modern railroad train. Cars have tripled and engines have doubled in weight during the past three or four decades. Speed, also, has gone up to a higher figure, and with all this there has come an enormous increase in the energy, the destructive energy, of the train when it is developed by collision, derailment or other form of accident. Let us prove this by figures. The modern steel car weighs 70 tons and the modern express locomotive 200 tons. Such a locomotive on level tracks can haul ten such cars at a speed of seventy miles an hour, and on a down grade 80 miles an hour or more. At 70 miles an hour a train weighing 900 tons would have a striking energy of 150,000 foot-tons. If through disobedience or failure to see signals it dashed at full speed into a stalled train, it would strike a blow equal to that delivered by three of our latest 12-inch naval guns—and each of these, be it remembered, can bore a 12-inch hole clear through some 42 inches of iron.

How many engineers of fast expresses realize that if they were riding three 12-inch shells delivered at point-blank range, they would hit the target no harder than the fast-flying train which they hold in their hands would hit a standing train ahead.

Now when from 50,000 to 150,000 foot-tons of energy is suddenly arrested, whether by the instantaneous shock of collision or by the more gradual and multiplied shocks of a derailment, something has got to go; and just how it goes is shown by the accompanying series of photographic views of more or less notable railroad accidents which have occurred during the past eighteen months. They represent photographs of wrecks which were investigated by Mr. H. W. Belknap, Chief Inspector of Safety Appliances for the Interstate Commerce Commission. Federal inspection of railroad wrecks is a development of the past few years, and one has only to read the many careful and intelligent reports which are regularly issued by the Commission to understand that this section of their work is one of the most powerful of the many influences which are now working for the promotion of safe railroading.

The writer has selected these views with a view to emphasizing two truths: First, the peril of the faulty steel rail; and second, the merciful protection to life and limb which is afforded by the steel car. The first photograph shows the results of a derailment caused by a broken rail which occurred August 25th, 1911, on the Lehigh Valley Railroad near Manchester, N. Y., and resulted in the death of twenty-nine persons and the injury of sixty-two others. The track was first class and well maintained, consisting of 90-pound rails, with tie plates on each tie, the rails being double spiked on the inside of the rail through the plates. The train consisted of two engines and fourteen cars. The rail broke, probably under the engine, at a point 247 feet west of a steel girder bridge over Canandaigua Outlet. Two cars fell over the bridge. The first dropped endwise, and in it the majority of the fatalities occurred. The second car fell and stood on end as shown. The pieces of the broken rail were sent to the Bureau of Standards, Washington, and most carefully examined. It was found that the rail was what was known as a "piped" rail, and the report states that the piping or seam split could be seen in practically every portion of it. The illustration in the corner of our engraving shows this pipe represented by the fine black line extending through the vertical web. No inspection of the track could possibly detect a defect so completely concealed.

This accident, then, is chargeable to faulty work at the rail mills.

There is probably no defective member of which the railroad man stands in greater fear than the "piped" rail. It has been the cause of countless wrecks, some of them of the most disastrous character. The "pipe" is generally a hollow shrinkage cavity formed when the ingot is cast, which is closed up when the rail is rolled, and exists as an incipient flaw or fracture in the body of the rail, where it is generally entirely hidden from sight. Under the stress of traffic, cracks develop, spread and ultimately result in complete fracture. Illustrations VI and VII show broken sections of a rail which went to pieces under a train on the Great Northern Railway near Sharon, N. D., causing the death of five people and injuring eighteen others. The entire train of eight cars was derailed. The head of the rail was found to be split for a length of nearly eight feet, but the investigation showed that the initial rupture at the time of derailment was a crescent-shaped fracture in the base of the rail (shown in illustration No. VII) due to inclusions in the metal. The split head was due to segregation of the phosphorus and sulphur in the rail and irregularity in the carbon contents. These defects are chargeable to the present unsatisfactory methods of rail manufacture. They are curable by the use of such methods of ingot casting as that shown in our issue of December 21st, 1912, describing the Hadfield method of casting ingots.

The 90- and 100-pound steel rail, if properly made, will stand up to its work even under the exacting conditions of present heavy and fast traffic, provided it is thoroughly fastened to the ties, and ties and roadbeds are maintained in absolutely first-class condition. Illustrations III and IV show the derailment at Hyde Park, New York, March 31st, 1912, of the Twentieth Century Limited, while it was running on a 2-degree curve at a speed of 50 to 60 miles an hour. Says the Interstate Commerce Commission Report: "It is believed that the use of shims (small blocks of wood used to raise the tracks and placed between rails and ties), together with irregularities or unevenness in the track, so weakened the track structure that it could not withstand the strain due to the heavy locomotive and trains rounding the curve at high speed, and the outside rails were forced outward, probably by the engine."

From the point of derailment the outside rail of the curve was turned completely over for a distance of about 1,700 feet. The first rail to be disturbed is marked 1 in illustration II. On the inside of this rail eleven spikes were partially drawn, and on the inside of rail 1 the outside ties had been crowded outward more than their width. The engine, tender, a buffet car and one sleeping car remained on the roadbed. The remaining five cars, four of them of steel, rolled down the embankment and came to rest on the heavy ice of the Hudson River. This served to show first the insufficiency of the common form of track fastening to hold the outside rail on curves up to its place against the centrifugal thrust of the modern heavy high-speed train. The remedy is to be found in using tie plates beneath the rail on every tie and substituting the powerful screw spike for the archaic and very inefficient wedge spike, which, after all is said and done, is nothing more or less than a nonsplitted nail. The other lesson taught is the wonderful protection afforded by the strong steel car, which, even under such rough handling as this, was neither telescoped nor crushed. The picture of these cars lying intact on their sides, on the ice of the Hudson River, speaks for itself.

Further proof of the remarkable strength and stiffness of the steel car was given in the wreck last November of a fast passenger train on the Pennsylvania Railroad at Glen Loch, Pa. This was a heavy fourteen-car train of steel construction hauled by two engines. A box girder on a bridge which the train was crossing yielded under the weight of the two engines, the depression being about 18 inches, and the jar derailed the train. Five of the 75-ton steel sleeping cars were thrown down the embankment, the cars shutting up concertina fashion and coming to rest in the positions shown in the illustration No. IX, published by courtesy of the *Railway Age Gazette*.

Years ago, when the SCIENTIFIC AMERICAN was advocating steel-car construction, we pointed out that instead of the telescoping which was so frequent and so destructive of life with wooden car construction, the train of steel cars would probably yield at the couplings, the energy of the train being absorbed in folding up, as it were, the train. Now this is exactly what happened at the Glen Loch derailment. The only steel car seriously damaged of those shown in this picture is the one at the right hand, which turned over on its side, its roof colliding with a loaded coal car, and the relatively frail roof structure inevitably crumpling up under the force of the impact. Four people only were killed. Forty-nine were injured by being thrown around the cars.

The fragility of the wooden car and the fact that the work of developing the energy of the train will occur at its weakest point is shown in the illustrations V and VIII of a wreck on one of the southern railroads. The derailment was due to poor track conditions. The energy of the after part of the train, which remained on the track, completely telescoped two rather flimsy tourist wooden cars into less than the space formerly occupied by one of them. By far the most significant

(Concluded on page 102.)

I. A broken rail, due to pipe (corner cut) caused this wreck. Loss 29 killed, 62 injured.

II. View showing where an express [illegible] spread the track. Damage begins at rail 1, where eleven [illegible] were pulled.

III. Wreck due to spreading shown in adjoining cut. Note excellent condition of the steel cars.

IV. This train running at 60 miles an hour was derailed at a bridge. Note ex[illegible] condition of the steel cars. Roof of first steel sleeper smashed by coal car.

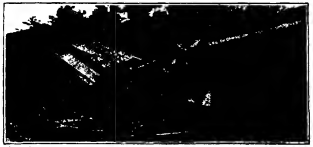


Photo. by Henry

V. The two weakest cars (wooden) in this train were telescoped into the space occupied by one car.

VI. Split head [illegible] to pipe.

VII. Base fracture where [illegible] began. The rail shown in VI and VII [illegible] loss of five lives.

VIII. General view of derailment which telescoped the wooden cars shown in opposite illustration.

These three illustrations show the relative behavior of steel and [illegible] cars in the disastrous rear-end collision at Corning, New York.

IX. Between engine and steel car is wreckage of wooden car.

X. Steel car after crushing wooden [illegible] and two thirds of wooden sleeper.

XI. Steel car and wrecked two thirds of sleeper.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

REVERSIBLE VEST.—W. FREEMAN, 840 Jefferson Av., Brooklyn, N. Y. The invention relates to a form of reversible vest and more particularly to that class wherein the different faces present vests of different character. It is adapted to be worn to present in effect either a single or double breasted vest and a vastly different appearance along the fast ening line is eliminated and a smooth tailored effect is produced.

SHOE HEEL.—H. ROSENBERG, 968 Kent Av., Brooklyn, N. Y. This invention provides a cushion section for a shoe heel and a wearing surface therefor rigidly secured thereto, provides a heel with a felt section leather covered to harmonize the appearance of the section with the shoe upper and the wear ing lifts, and provides means for uniting the felt section and the body of the shoe.

POCKET BOOK AND POWDER PUFF.—A. WINDLER, 1037 3rd Av., Manhattan, N. Y., N. Y. The invention is an improvement in pocket books and supplies an article having a false bottom . . . . bottom . . . . be . . . . puff to be used.

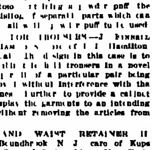
CABINET FOR TROUSERS.—J. FINNERTY and J. I. HAMILTON, care of J. I. Hamilton, Red Bluff, Cal. The design in this case is to provide a cabinet to hold trousers in a novel manner to . . . . of a particular pair being readily . . . . . . without interference with the remaining ones. Further to provide a cabinet that will display the garments to an intending purchaser without removing the articles from the cabinet.

SKIRT AND WAIST RETAINER.—H. GITIGS, R. Brandbrook, N. J., care of Kups Bros., 16th St. and Irving Place, New York, N. Y. This retainer is adapted to be removably fastened to the front steel of a corset and an object is to provide a device which may be used to hold a skirt in position and to afford means for holding the shirtwaist tap or band in place close to the band of the skirt to afford a neat smooth connection at the waist.

Pertaining to Aviation.

CONTROL FOR AEROPLANES.—W. A. BARTHOLOMEW, Ravenna, Mich. This improvement relates more particularly to a device for the transverse controlling of the planes and provides a structure which will act at or near the extremities of the planes or other convenient points for causing the aeroplane to maintain its proper equilibrium or return to its proper position quickly when moved therefrom.

FLYING MACHINE.—B. QUESADA, San Jose, Cal., care F. W. Dinaggi, 414 San Jose Bank Bldg., San Jose, Cal. This invention comprehends a number of distinct features relating to the wings, the prime mover and its connection with the propellers, a truncated conical body portion, and various other mechanical features for increasing the efficiency. The



FLYING MACHINE

essence of these improvements lies in the particular curvature given to different parts of the wings and the mechanism for conforming these curvatures and maintaining the same. The stability obtained by shaping the wings is almost positive and enables the machine as a whole even after power is shut off completely to descend almost as easily and as gracefully as a parachute. A side elevation of the machine is shown in the engraving.

Electrical Devices.

TELEPHONE INSTRUMENT.—M. M. RAY, S. . . . care of American Tel. Co., 66 Broadway, New York, N. Y. This inventor provides supporting means for the receiver to dispense with the need of holding the receiver in the hand, provides supporting means for the telephone receiver which will be moved to service position automatically; has the necessary circuit to the instrument provides a means where by when use of instrument is discontinued the circuit is automatically cut off, and provides means for at will locking the instrument in position to maintain open the line circuit during intervals of suspension of use.

TELEPHONE ATTACHMENT.—M. M. RAY, S. . . . care of American Tel. Co., 66 Broadway, New York, N. Y. This invention relates to an attachment whereby the user will not be put to the inconvenience of holding the receiver while talking and whereby he may have both hands free to take notes of the telephone conversation if necessary.

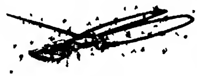
ELECTRICAL MELTING AND SOLDERING APPARATUS.—W. M. BOWLES and C. O. ALLAN, 117 N. Philadelphia St., Shawnee, Okla. An object of this improvement is to provide a heating device for use in melting or soldering metals with great facility and with a minimum expenditure of heat. A further purpose is to provide a portable device which can be readily connected to an electric circuit.

RHEOSTAT.—W. M. BOWLES and C. O. ALLAN, 117 N. Philadelphia St., Shawnee, Okla. An object here is to provide a variable resistance for controlling an electric current in which the resistance members consist of a series of carbon disks. A further object of the invention is to provide means for varying the contact between these disks and thereby throwing into the circuit more or less resistance.

Of Interest to Farmers.

FARM GATE.—A. M. DOYLE, Leoti, Kan. This invention has reference to operating devices for gates such as are used specially in rural places and where it is desirable to avoid the inconvenience and frequent danger to a person traveling alone from dismounting from his horse or vehicle to open the gate.

CATTLE STAKING DEVICE.—R. J. LEE, care of Blue Ridge Hosiery Mill, Landrum, S. C. This invention has reference more particularly to a device comprising a manipulating member, a chain or other flexible element secured at one end to the manipulating member and serving for the fastening or staking out of an animal and means associated with the manipulating member whereby the flexible member can be taken up and shortened. Be

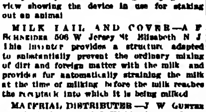


CATTLE STAKING DEVICE

sides for use in staking cattle or other animals for grazing it can be employed in driving cattle or in fastening or tying them under different conditions with means for carrying the chain or other flexible tying member so that the latter cannot become entangled or endanger the animal or the driver. The flexible member can be lengthened or shortened within the limits of its length which can be very easily manipulated. The engraving gives a view showing the device in use for staking out an animal.

MILK PAIL AND COVER.—A. F. SCHNEIDER, 506 W. Jersey St., Elizabeth, N. J. This inventor provides a structure adapted to substantially prevent the ordinary mixing of dirt and foreign matter with the milk and provides for automatically straining the milk at the time of milking before the milk reaches the receptacle into which it is being milked.

MATERIAL DISTRIBUTER.—J. W. GUNTER and J. A. HAMBY, 112 Highland Ave., Montgomery, Ala. The invention has for its object the provision of an inexpensive machine wherein means is provided for insuring a regular and uniform feed of the material operated directly by the movement of the machine and



MATERIAL DISTRIBUTER.

wherein the feed may be regulated to suit conditions. In operation a cut off is set to feed the requisite amount of fertilizer and is held in this position. The machine is drawn over the ground the wheel in front rotating the shaft and causing the fertilizer to be fed through the chute. The plow opens a furrow to receive the fertilizer and a plate covers the fertilizer in the furrow. The accompanying illustration shows a side view of the distributer.

DRILL SHOE.—F. KRAUSE, care of Tobias D. Casey, Dickinson, N. D. The purpose here is to provide a shoe having an elongated body with its rear flared at the bottom and a seed spout secured to the body with its bottom bent for directing the seed under the flared portion of the shoe. The seed spout is open at its rear end and closed at its front end to prevent its being clogged with dirt.

WEED CUTTER.—J. F. BORCHERS, Cashmere, Wash. This implement clears the ground of weeds of the type which is designed to be pulled by a draft animal when in operation, and it comprises a frame carrying means for cutting weeds and other objectionable vegetable growths and supported upon a plurality of adjustable guides which enable the frame to move over the ground at any height therefrom.

PEANUT THRESHING DEVICE.—C. R. LIVERMON, Roxobel, N. C. An object in this invention is the provision of a means for separating the peanuts from the vines and for delivering the peanuts cleared from chaff and dirt from one part of the machine and for discharging the vines from another part of the device.

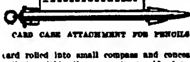
Of General Interest.

FIRE ESCAPE.—M. FINK, 15 W. 118th St., Manhattan, N. Y., N. Y. This escape permits a person to safely lower another or a number of persons successively from a burning building to the ground, and allows persons to lower themselves, and without danger of injury by falling or by striking the ground

FIRE ESCAPE.

on being lowered or in case the person should lose his grip. Use is made of a rope for attachment at the upper end to a fixed holder located at or adjacent to a window or other opening and a supporting harness permanently secured to the lower end of the rope and adapted to be attached to the person intending to escape. The illustration shows a perspective view of the fire escape as applied.

CARD CASE ATTACHMENT FOR PENCILS.—A. B. SCOTT, Fairmount, W. Va. This invention more especially relates to pencil attachments for holding an identification card or the like and objects of the improvement are to provide an attachment that may be applied to an ordinary pencil and hold the



CARD CASE ATTACHMENT FOR PENCILS

card rolled into small compass and concealed entirely within the case to provide for the control and manipulation of the pencil to project and withdraw the lead by operations independently of the case and holder and to provide holder of neat and compact construction. The engraving shows the body of the card case removed and the end member or cap of the case in section the card being shown unrolled.

BUMPER.—F. PHILIPPIN, care of Brevoort House, 5th Ave. and 8th St., New York, N. Y. This invention refers generally to bumpers, and more particularly to an article especially adapted for use on the bow of a vessel or boat, whereby the liability of damage to a vessel or boat in the event of collision is mate-

BUMPER.

rially reduced. The bumper is of a resilient construction and is provided with means whereby it may be efficiently held in position on the ship. A perspective view is shown in the engraving of the bumper in position at the bow of a vessel.

SAMPLE CARD.—B. F. . . . . plex Litho. Co., 444 1st Ave., Manhattan, N. Y., N. Y. It is customary in . . . . fabrics to cut up material into pieces and card or "mount" them, and this entails large expense, not only for sample materials, but for the labor of cutting and . . . . material to the cards, and it is . . . .

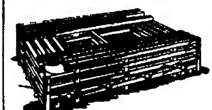
. . . . display . . . . without the necessity of . . . . samples actually cut from goods that . . . .

CONTRACTIBLE UMBRELLA.—A. M. . . . . 1444 Park . . . . ., Wichita, Kan. In this umbrella the canopy together with the staff, is adapted to be shortened and inserted in the handle as when the umbrella is not in use. For this purpose the handle is expansible so as to open out when the canopy and staff are passed within it, and assume a conventional size when used as ordinary.

SUPPORT FOR CONCRETE REINFORCEMENTS.—C. A. KOSMAN, 511 Walker Bldg., 5th and Market Sts., Louisville, Ky. This invention has reference to supports for the steel or other reinforcements for concrete, and has for its purpose the provision of a structure which will correctly support the reinforcing members without defacing the finished work.

ACETYLENE-OXYGEN WELDING TORCH.—J. D. FRIAR, care of Fred. H. Buchanan, Centerville, Kan. This inventor provides a simple and inexpensive device for receiving and mixing the gases, wherein means is provided for thoroughly mixing the said gases as they pass to the outlet and without delaying their passage.

LIFE RAFT.—B. N. MATSON, Boston, Mass. This raft is intended to be carried by marine vessels, and the device is formed of a plurality of buoyant members, and airtight and food tanks crated in the buoyant members, all forming the raft. The raft with parts of the



LIFE RAFT

frame or crate cut away and showing the food tank is pictured in the accompanying engraving. It is safe simple and rigid in construction and equally efficient when being launched either side up. The buoyant members inclose a plurality of air and food compartments evenly spaced and crated by the buoyant members, and guaranteed from injury by the said members.

COMBINED CIGARETTE BOX AND MATCH HOLDER.—H. A. GRIFFIN, Drawer R, Rocky Mount, N. C. The match holder and igniter is pasted on the front of the cigarette box proper and is so constructed as to normally cover and protect the fulminate ends of the matches but serves to ignite a match when being withdrawn.

ICE MAKING APPARATUS.—S. R. BELL, 498 Walnut St., Beaumont, Tex. The intention here is to provide an apparatus having combined means for making the ice and for cooling the brine which is used in the ice making process thereby dispensing with additional apparatus for cooling the brine.

LIFE BOAT.—P. E. BÜROW, 1118 8th Ave., Brooklyn, N. Y. An object here is to provide an open top power boat which cannot fill by the breaking of the seas over the same and which is so constructed as to obtain the maximum bearing surface upon the water and which has its center of gravity relatively low.

DEVICE FOR HOLDING AND DISPENSING BEVERAGES.—J. VERNANO, care of B. D. BERNADI, Santa Rosa, Cal. The aim of this inventor is to provide a barrel, tank or other receptacle or container, with a plurality of separate compartments adapted to contain liquids of different characteristics together with a single dispensing faucet having com-

DEVICE FOR HOLDING AND DISPENSING BEVERAGES.

munication with each of said receptacles or container compartments, and so constructed that a liquid . . . . compartments may be . . . . mixture with the . . . . ing this invention.

PORTABLE . . . .—F. L. Mayne, care of . . . . Ave., ..., Pa. This . . . .

of the harness; and provides a frame having means incorporated therein for adjustment to suit service conditions of the trough when used by horses of various builds.

VAPORIZER.—G. A. Evans, 909 Bedford Ave., Brooklyn, N. Y. This vaporizer is used for giving off, or in a certain sense exhaling particles of medicinal substances through air passed thereover so that the medicinally charged air may be used for the treatment of diseases of the lungs and the air passages.

COMBINED CUFF BUTTON AND CUTTER.—L. Kalisa, care of Midget Mfg. Co., 175 Center St., New York, N. Y. The intention in this case is to provide a new and improved combined cuff button and cutter designed to be worn as a cuff button and adapted to be used as a cutter for use in cutting finger nails, cigars and the like.

FOUNDATION.—R. Frankignoul, 196 Rue Gretry, Liege, Belgium. This invention relates to the making of foundations of buildings and structures in a manner to enable the verticality or horizontality of the buildings to be quickly and easily restored, should they be interfered with by movements of the ground due, for example, to mining operations.

PROCESS FOR TREATING RAW POTATOES IN ORDER TO OBTAIN BOTH A CATTLE FOOD AND A PROTEID.—H. Gumpel, Schlagenthin, near Damsdorf Müncheberg, Germany. The process is effected by separating the juices from the potatoes after they have undergone a suitable preliminary treatment and to use these juices for the manufacture of the proteid substances, while the solid residue is used for the manufacture of the durable animal food.

BOOT CLEANER.—A. M. Fairfield, St. Marys, Kan. The cleaning devices are placed on the floor, and conveniently supported to permit the user to place his foot against the scraper and brushing members. The object is to provide a cleaner, to the end that the shoe may be quickly and efficiently cleaned by the brushing elements of the cleaner.

MUSIC HOLDER.—E. J. Barrett, Onaway, Mich. This invention relates more particularly to holders adapted for use on pianos and like instruments, and provides a construction light in weight, readily portable, which may be quickly and easily set up in operative engagement with the piano or other instrument and detached therefrom.

CARD INDEX.—L. C. Reynolds, 712 Quincey St. N. W., Washington, D. C. This improvement is in indexes in which a series of cards having names or matter printed thereon, in alphabetical order, are held detachably in a frame one above another, so that the matter is always visible on the faces of the cards, each of which is provided with some form of device adapted to engage and support the one above it.

FLUID ACTUATED GONG.—G. R. W. Rommers, 2346 San Antonio Ave., Alameda, Cal. This invention relates to gongs for street railway cars, or any other vehicle which has an air brake system or is capable of carrying fluid under pressure. It provides means whereby to continuously sound a gong without effort on the part of the operator subsequent to the opening of a valve for the purpose of starting the actuation.

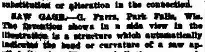
FEED REGULATOR FOR GRAVITY CONCRETE MIXERS.—G. W. Mills and J. E. Simpson, Georgetown, Pa. The invention provides a device wherein the different materials forming the concrete are mixed in the proper quantities, during their passage by gravity through the device, and wherein means is provided for insuring the proper distribution of the materials before the mixing operations begins.

Hardware and Tools.

WRENCH.—C. G. Youngquist and C. F. Youngquist, 526 Henry Bldg., Portland, Ore. This invention provides a wrench with jaw members which are movable relatively to their supporting heads to assist in obtaining a firm hold on a pipe, resilient means being provided for holding the jaw members yieldingly in position relatively to the supporting heads.

FAUCET CONNECTION.—P. F. Kistlow, care of Dr. E. M. DeCastro, 895 Union St., Brooklyn, N. Y. The invention pertains to connections for water spigots, particularly to those for connection with shower bath or bath spray apparatus. A hose connection or the like is made to spigots or reducers of various sizes, without the necessity of making any substitution or alteration in the connection.

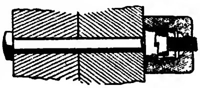
SAW GAGE.—G. Ferris, Park Falls, Wis. The invention shown in a side view in the illustration is a structure which automatically indicates the bend or curvature of a saw applied thereto. The gage indicates on a scale the amount of curvature, the action of the



SAW GAGE.

[illegible] automatic upon placing the gage [illegible] the saw or other [illegible] having a centrally [illegible] held in an [illegible] mounted arm which moves over a graduated scale whereby when the support is placed upon a surface the motion is transmitted to the pointer for indicating the degree of curvature of the surface to which the gage has been applied.

NUT LOCK.—C. J. Ivers, Rushmore, Minn. This invention has for its object the provision of a nut which may be screwed upon a bolt, but which when once adjusted, is prevented from becoming unloosened, and which will, in fact, have to be cut off if it is ever removed. A further object is to provide a simple and inexpensive form of device for absolutely pre-



NUT LOCK.

venting the removal of the nut by unscrewing it when it is once in position. The device is designed for use on structures in which the permanent position of the nut is desired, and is shown in the accompanying illustration in a section through the nut after it has been applied.

FLUE EXPANDER.—J. B. Anderson, Clipper, Wash. In this case the invention has reference to improvements in flue expanders, and it has for an object the provision of an improved structure in which a screw construction is provided for feeding the device forward during the expanding of the tube.

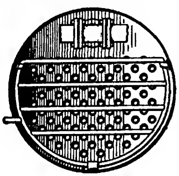
SCREW DRIVER.—G. B. Mullen, 18th St. and 7th St., Whitestone, New York, N. Y. This invention relates to screw drivers for inserting and withdrawing wood or other screws, and has reference more particularly to one having a shank, a blade at the end thereof and adapted for engagement with a screw head and a clamp associated with the driver and adapted to hold the screw in position relative to the blade.

KNIFE.—J. A. Hanson, 141 Riverside Drive, New York, N. Y. The object here is to provide a knife having a detachable blade which is held against the handle by a hook rod, the hook on the rod engaging the blade around an orifice and the rod being secured in a channel in the handle. The blade is reinforced by a bar, the butt end of which is disposed in a socket handle.

Heating and Lighting.

FIREPLACE.—G. L. Perrins, Sanford House, Excelsior Springs, Mo. Mr. Perrins's invention is an improvement in that class of fireplaces in which the side walls converge to the rear and a horizontal ledge or step extends between such walls. Practical use of the invention has demonstrated that in this fireplace a maximum calorific effect is produced with a minimum of fuel.

SMOKE CONSUMER.—R. H. Sharp, 2334 Tower Grove Ave., St. Louis, Mo. The invention relates to smoke consumers and it has for its object to provide a flue boiler with pipes with openings at the front of the boiler through which air may be carried to mix with the heated gases coming from the flues at the front of the boiler to complete the combustion.



SMOKE CONSUMER.

Various applications of the invention may be used, since the invention includes all constructions in which air is admitted between the fire chamber and the smoke-stack, whether flue boilers are used and whether the boilers are stationary or of other types. The engraving represents a sectional view of the boiler, to which the smoke consumer is applied.

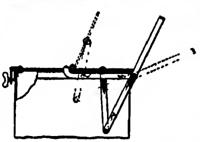
ACETYLENE GAS GENERATOR.—J. F. Williams, 41 Warren St., New York, N. Y. The object here is to indicate at all times the amount of carbid in the feed hopper and to sound an alarm whenever the carbid in the hopper reaches a low stage, and whereby a supplementary charge of carbid within the hopper may be added to permit of running the acetylene gas generator another length of time, say overnight, before being required to recharge.

CAST IRON BLAST HEATER.—K. Meier, 12 Fuchsbrunnen, Winterthur, Switzerland. This heater is arranged to provide a large heating capacity for the air in a comparatively small space, to permit increased velocity of the air and to minimize the resistance to the flow of air and reduce the power required for forcing or drawing the air through the steam, hot water or other heater and to avoid dead air spaces and thereby make the heater self cleaning.

BOILER.—W. Johnson, University Place, Neb. The invention has for its purpose the provision of a boiler suitable for providing steam for motors, or for heating systems, having a special form of heating means, arranged to give the largest possible amount of steam per heat unit.

HOT WATER HEATER AND STERILIZER.—C. J. Madonna, 443 7th Ave., Brooklyn, N. Y. The intention here is to provide a hot water heater and sterilizer more especially designed for use in barber shops, hospitals and other places and arranged to furnish a supply of hot water for shaving, and washing purposes, and at the same time permit the sterilizing of a large quantity of towels, napkins and the like.

ASH CAN COVER.—E. M. Coryell, 410 Richmond Ave., South Orange, N. J. This inventor provides a cover separable from the can which may be opened by laying the shovel with the ashes thereon on a projecting bracket the weight of which shovel and contents will automatically open the cover to permit the quick insertion of the ashes into the can, the withdrawal of said shovel automatically closing the cover. The cover is of two parts hinged together, one adapted to be removably



ASH CAN COVER.

fastened to the can and carrying a support projecting forwardly of the other part which support forms a fulcrum for the lever. One end of said lever is attached to said other part, and the opposite end of the lever projects forwardly of the can as a rest for the shovel. A side elevation of the invention attached to a can, parts being broken away to show the attachment, and the lid and its attached parts shown in raised position in dotted lines, is illustrated herewith.

Household Utilities.

FLUSHING DEVICE.—A. Williman, care of N. C. Abbott, 710 1st Nat'l Bank Bldg., Houston Heights, Texas. In the present patent the invention has reference to a flushing device that will operate to flush a closet, or other apparatus, without the use of a separate water tank and obviate the attendant disadvantages of a water tank.

BROOM HOLDER.—W. J. Horn, Tunica, Miss. Means is here provided for connecting a broom to a handle in such manner that a considerable degree of resiliency is permitted between the broom and the handle and wherein the clamping means may be adjusted for brooms of various sizes, and wherein the handle may take a position at an angle with respect to the body and wherein a positive gripping means is provided in connection with the clamping means.

WEATHER STRIP.—G. L. Godfrey, 1530 Bryant Ave., New York, N. Y. This invention provides a metallic strip to close an aperture irregular in form and varying in width, and provides a rigid metal casing, a movable stop member mounted therein, and means carried in said casing for compelling the sections of said stop member to conform with the contour of the opening to which the strip is applied.

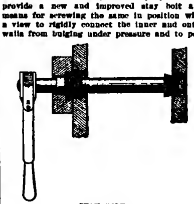
COMBINED MOP HOLDER AND WRINGER.—J. W. Kauboek, Darwin, Minn. This invention provides a mop having a construction adapting it for combination with a scrubbing device, improves the elements entering into the operation and supporting means of the mop head device, and provides a scrubbing device having means for holding a scrubbing brush adapted for co-operation with the novel mop heads and their appurtenances.

CHILD'S PORTABLE HIGH CHAIR.—F. Gassman, R. F. D. No. 3, Alva, Okla. This invention is an improvement in legless high chairs, in which the seat and back are hinged and adapted to fold together, and provided with a hook like attachments adapted for supporting the chair-proper on the back of an ordinary chair, or on hooks or other devices secured to a wall or other rigid support.

SINK FRAME BRACKET.—W. J. Daly, 314 N. Main St., Mason City, Iowa. The bracket is simple and inexpensive, and may be of any desired size and weight. The parts may be made in stock sizes and adjusted to a wide variety of dimensions. The sink is held firmly and without any possibility of accidental dislodgement, yet is easily removable for cleaning or repairs.

Machines and Mechanical Devices.

STAY BOLT AND MEANS FOR SCREWING THE SAME IN PLACE.—W. L. Decker, per Calicia No. 9 Mollendo, Peru. The invention relates to boilers, and its purpose is to provide a new and improved stay bolt and means for screwing the same in position with a view to rigidly connect the inner and outer walls from bulging under pressure and to per-

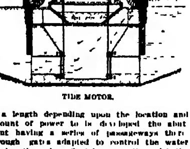


STAY BOLT

mit of conveniently and quickly screwing the stay bolt in place or removing the same when necessary. The engraving herewith shows a side elevation of the stay bolt partly in position on the inner and outer walls of the boiler, the boiler walls and guide nut being represented in section.

CONCRETE MOLD.—W. H. Alexander, Box 175, Long Branch, N. J. The object here is to provide a mold having a bottom member which may be conveniently raised and lowered so that a detachable end member will rest on the ground, the mold being provided with side members which have clamps for engaging the detachable end member and means by which the side members are moved laterally relatively to the bottom member.

TIDE MOTOR.—F. D. Taylor, 911 Pontiac Ave., Providence, R. I. This invention relates to hydraulic motors and particularly to power devices adapted to utilize the force of both the ebb and flow of the tide. The motor comprises a fixed abutment constructed at any convenient place such for instance as at the mouth of a bay, inlet, or river of a height preferably slightly below the water line at low tide and



TIDE MOTOR.

of a length depending upon the location and amount of power to be developed, the abutment having a series of passageways therethrough, gates adapted to control the water passing through, a float in connection with the abutment, shafts for operating the gates and means carried at a uniform elevation of the float for operating the gate controlling shafts during changes in the elevation of the float. The illustration shows a vertical transverse section of the invention.

ADJUSTABLE STOCK FOR FIREARMS.—O. E. Oliver, Mount Eden, Alameda Co., Cal. Mr. Oliver's invention is an improvement in that class of gunstocks in which the butt section or stock is pivoted to the front section or grip, so that the two may be adjusted at differ-

ADJUSTABLE STOCK FOR FIREARMS

ent angles to each other. By the construction and combination of the various parts a joint is formed distinguished by simplicity, lightness, strength and rigidity. The butt section is adjusted up or down to suit a long or short-necked gunner or sportsman or it can be adjusted sidewise to the right or left to suit a wide or narrow shouldered man or a right or left handed gunner as the case may be. The accompanying engraving shows a longitudinal vertical section through the pivoted adjustable stop.

FARE RECEPTACLE.—G. C. Stewart, 2604 W. Main St., Louisville, Ky. This improvement is in receptacles in which are deposited the fares of passengers of pay as you enter cars and other vehicles used for public transportation. All coins taken from passengers and deposited in the mouth of the receptacle must drop into the box before the base of the receptacle can be opened and the box removed; and, hence, the danger of loss to a

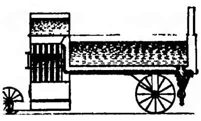
company through thieving is reduced to the lowest minimum

THREAD CUTTING ATTACHMENT FOR SEWING MACHINES.—Robert L. Colay, care of James W Cannon, Concord N C. The object in this case is to provide a simple attachment capable of attachment to any form of machine with but little change and for automatically cutting the thread between articles without stopping the machine and without injuring the article

VALVE GEAR.—E I Robertson, 220 Mulberry St., Greenville S C. The present invention has reference to valve gears in which the valve rod receives its motion from the usual link mechanism and return crank through the medium of a lap and lead lever having a link and hanger connection with the cross head of the piston rod

MOTOR STARTER.—A J Charlton, Lowden, Iowa. This improvement is in motor starters in which a spiral member co-acts with another one being rotatable so that by sliding or rectilinear adjustment of one of the members, the other one is rotated with the effect of imparting rotation to the motor shaft

MACHINE FOR HEATING AND DISTRIBUTING MATERIALS.—J F Decker, 7 Third Ave, Albany N Y. This invention has reference to machines for use in heating and distributing materials, and it has for its object to provide such a machine which may be used



MACHINE FOR HEATING AND DISTRIBUTING MATERIALS

to heat crude oils, asphalt etc and to distribute them on roads. The machine is provided with a water boiler and a tank for the materials which are heated, steam from the boiler being supplied in jets to the nozzles which distribute the material on the road. A longitudinal sectional elevation of the invention is represented in the illustration

MEANS FOR CASTING FINGER RINGS.—F H Curl, 2116 E 4th St, Longbeach, Cal. The invention relates to molding operations similar to the means set forth in a previous patent granted to Mr Curl. The primary object is to improve the means for casting finger rings or similar symmetrical articles, whereby the operation may be performed much more rapidly and cheaply and with less mechanism or fewer parts than was necessary in the previous operation

MACHINE FOR CAPPING AND DOUBLE SEAMING CANS.—H L Guenther, 278 N Ave 23, Los Angeles, Cal. This inventor provides a machine for capping and double seaming cans, arranged to restore the mouths of can bodies which have become distorted while being filled or handled to press the fruits or other food products, that may extend above the edge of the can body downward into the same to place the can heads in position in the can bodies and to double seam flanges of the can bodies and heads, and to compress the seams to render the same airtight without the use of solder and to remove the finished cans from the machine

WINDMILL.—W T Santala, P O Box 353 Georgetown, Conn. The object here is to provide a mill arranged to hold the windmill at all times in the wind and to permit of exposing more or less of the wheel to the action of the wind according to the power thereof thus insuring a proper running of the wind wheel in light or heavy wind

CLOSING DEVICE FOR DYEING VATS.—C P Delahunty, care of Delahunty Dyeing Machine Co, W Pittston, Pa. An object of the present invention is to provide a readily manipulated cover which may be actuated manually irrespective of its weight and is especially adapted for large sized tanks where some mechanical arrangement must be utilized in order to entirely uncover the vat so that the opening is entirely unobstructed when filling the vat

ABRASIVE BELT MACHINE.—C H Dunsy, care of John C Stephan, Midland Furniture Co, Evansville, Ind. This invention has reference to abrading or polishing machines and has particular reference to devices of this character adapted for a wider range of adjustment and field of operation than other machines previously proposed

DEVICE FOR EXHIBITING PICTURES.—A S Warren, 20 Prospect St, Batavia N Y. This device involves reels or spools for receiving a strip bearing pictures that may be brought into view successively and it is a design to provide a device wherein a plurality of supporting and guiding devices are so arranged that a strip bearing pictures on opposite faces thereof may be so moved as to exhibit the pictures on either side of the strip or film

DITCHING MACHINE.—A E Hanson, Mason City, Iowa. The object of the present invention is the provision of a new and improved ditching machine arranged to readily form the ditch to any desired depth, and to divide the material and deliver the same to opposite sides of the ditch in a very simple and economical manner

MACHINE FOR USE IN THE MANUFACTURE OF INCANDESCENT GAS MANTLES.—J I Robin, 54 Cheapside, London, England. This invention has reference to the manufacture of incandescent gas mantles, and while it is particularly applicable to mantles of the kind which are composed of loose strands or threads it may also be applied to the manufacture of any ordinary form of mantle

SWIVEL FOR HOISTING MACHINERY.—A C Graham, Oilfields, Cal. The invention provides a pivotal engagement for uniting the hoisting cables and the elevator links of a well casing and provides an engagement means for uniting the parts of a hoisting mechanism constructed and arranged to minimize the weight and economize the cost of construction

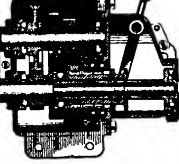
HYDRAULIC RAM CYLINDER.—O P Bushnell, care of Monarch Machinery Co, 30 Church St, New York, N Y. The principal object here is to provide a cylinder formed from cast steel and to avoid defects incident to the construction thereof. Other objects are sought such as forming a construction wherein the parts are stronger and lighter and to provide a structure wherein the method of manufacturing the same is simplified.

FLYING MACHINE.—W Phillips, Edison Park, Chicago, Ill. This is an improvement in flying machines of the helicopter type involving a vertically arranged car body within which the aviator is stationed and from which he has control of the machine by virtue of novel steering and balancing devices. The invention also includes among other details of importance a peculiar means for manipulating the legs upon which the device is supported when not in the air

REVOLVER.—R B Holmes, Ferndale South Bellingham, Wash. An object here is the arrangement of a structure having a high power confined to a minimum space. Still further is the arrangement of a revolver formed so as to be held in the palm of the hand so as to be substantially hid from casual observation and adapted to be quickly discharged upon the successive closing and opening of the hand

CHEESE MAKING MACHINE.—E Veaman, Jonre, Holland. By use of this machine the curd will be effectively broken up and thoroughly worked to a uniform and superior condition the mechanism having provision for effectively extracting the whey and effecting its discharge while collecting the curd in an annular layer in the containing vessel against the inside surface of the side wall of the vessel

CLUTCH.—J Chalmers, 82 River St., Quincy Mass. This invention relates more particularly to the clutch mechanism in transmission gearing in which the rotary motion is transmitted at different speeds through two sets of gears running on parallel axes of which gears some are loose on one of the shafts and



CLUTCH

are provided with a clutch device for connecting them at will so that the motion may be transmitted through any one of the gears desired and consequently at speeds proportionate to the ratio of these transmitting gears. The novel features reside especially in the peculiar construction and organization of the mechanisms for connecting the loose gears at will with the transmitting element co-acting therewith. The engraving shows a transverse sectional view taken longitudinally through the invention.

SCALE.—C M Sturgis, 1601 5th Ave., Birmingham Ala. This invention has particular relation to improvements in the construction and arrangement of parts composing a scale shown in a former patent granted to Mr Sturgis. The principal object which the present invention has in view is to simplify and economize the construction, and with this in view it consists in providing a main rocking bar and standards therefor having knife-edge alined supports for the bar.

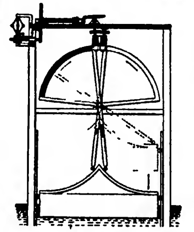
BARREL SOAKING AND RINSING MACHINE.—H Rainings, care of Consumers Brewing Co. New Orleans, La. This invention has for its purpose the provision of a new and improved apparatus which will quickly and continuously handle barrels, kegs or the like, for washing the same automatically after the same have been once fed into the machine.

PUMP OPERATING APPARATUS.—W Ellsworth, Smyrna, Wash. This invention is a means for converting rotary motion into reciprocating motion for the purpose of operating pumps and other machinery. It is especially useful for pumping water in irrigated districts, for emptying deep wells, or for supplying water from springs and streams.

Prime Movers and Their Accessories.

ROTARY VALVE FOR INTERNAL COMBUSTION ENGINES.—R O Witwer, New Hamburg, Ontario, Canada. The valve is arranged to control the admission of the explosive mixture and the exhaust for the products of combustion in a simple and effective manner to operate with uniform efficiency at all speeds, to reduce the water-cooled surface of the explosive chamber to a minimum, and to require but little power to actuate the valve

TIDE MOTOR.—W Braunsdorf, 3411 Broadway, New York N Y. The object here is to construct a tide motor which will utilize the buoyant force of the rising tide to lift a float, and which float during the flow of the tide will be operative through its weight to drive any suitable machinery in the same direc



TIDE MOTOR.

tion in which such machinery will be operated during rise and ebb of the tide. The inventor intends to use this motor power to operate electric dynamo machines, which power may be transmitted through electric wires for electric lighting and for operating different elevated, surface and underground railroads, etc. The illustration gives a somewhat diagrammatic side elevation view of the invention

CARBURETER FOR INTERNAL COMBUSTION ENGINES.—S K Bradford, P O Box 74, Palo Alto, Cal. This carbureter is for use with gas or petrol motors, particularly such as are used on auto vehicles and aerial machines. A feature is the automatic adjustment of the needle valve such adjustment corresponding to variations of barometric pressure due to difference of altitude the principle of operation being the same as that of the ordinary aneroid barometer

MUFFLER.—V R Still, 65 Baker St., Patchogue N Y. A principal object here is to provide for the elimination of sound accompanying the discharge of exhaust gases from internal combustion engines by absorbing the heat of the gases and thereby reducing the expansive force thereof to avoid back pressure on the exhaust of an engine of this character

Railways and Their Accessories.

CAR COUPLING.—B. Zuckerman, 612 Eleventh Ave, Manhattan, New York, N Y. The principal object of this invention is to provide a car coupler made up of few parts which, however are adapted to coöperate with one another in a secure and efficient manner whereby a new and improved structure of this class is provided. The coupling is automatically performed

TRACK ATTACHMENT FOR SWITCH SIGNALS.—H H Rice, care of Depot Quartermaster, U S A, Honolulu, Hawaii. This invention relates to safety appliances for railways and has particular reference to devices for signaling or giving indication to the locomotive engineer of the fact of an open switch, draw or the like which would be a menace to the train approaching the same.

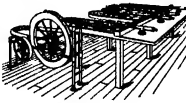
RAILROAD TIE.—J H May, 204 C St. Napa Cal. This tie is a shock-absorbing tie of reinforced concrete and will stand heavy traffic and in carrying out this feature the absorber operates to absorb a large portion of the shock and this together with the reinforcement of the tie provides one which will stand wear without breaking and will prevent rails from spreading.

Pertaining to Recreation.

GAME APPARATUS.—B. Kranchen, 416 62nd St., Brooklyn N Y. This apparatus comprises suitable devices for throwing a movable member representing a ball, and striking said member after being thrown, so as to propel it in different directions across the board, upon which is represented a base ball diamond having bases and base paths and provided with figures representing players.

SNELL FASTENER.—P H. Kimsey, 92 Harrison Place, Brooklyn, N. Y. This fastener is provided with a spaced line retaining hooks for engagement with the line and a snell retaining hook for engagement by the loop of the snell and arranged intermediate with said line-retaining hooks and extending in a direction opposite to the one of the line-retaining hooks.

GAME APPARATUS.—A Reibstein, 48 Stuyvesant St, New York, N Y. In this case use is made of a series of game tables shown in the illustration, an inclined runway extending in front of the tables, ball-impelling devices mounted at a right angle to the runway opposite the tables to permit of shooting a ball traveling down the runway off the latter



GAME APPARATUS.

and onto a corresponding table. Use is also made of a return chute connected at one end with a lower end of the runway and having branch chutes arranged adjacent the tables, and a driven wheel for receiving the balls from the chute and delivering them both to the beginning end of the runway. The invention relates to game apparatus in Letters Patent of the U S No. 1,018,342, formerly granted to Mr Reibstein

Pertaining to Vehicles.

SPRING WHEEL.—F W Brown, 507 Denegre Bldg. New Orleans, La. The purpose here is to provide a device which will simulate closely the action of a pneumatic tire and which has advantages that the pneumatic tire does not possess. Also to provide a wheel so arranged that portions may be easily taken apart or assembled.

WHEEL.—A McKillop, Downieville, Cal. This invention is an improvement in wheels, and has for its object the provision of a simple strong light weight wheel wherein is provided a pneumatic cushion between the spindle and the tread protected on all sides from ex

WHEEL.

ternal injury and imparting to the wheel a great amount of resiliency while of small size and inexpensive. The accompanying illustration shows a vertical section of the invention transverse to the plane of the wheel.

Note. Copies of any of these patents will be furnished by the Scientific American for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

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Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents subscriptions, books etc This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12730) F D asks I am trying to make small dry batteries Would like to try the formula for Dr C Gassner's dry battery on page 407 of your book Experimental Science by G M Hopkins, edition year 1899 and find the word plaster 3 parts etc used Now please tell me what is plaster? A. The formula given in Experimental Science for Gassner dry cells is the same as is always used in this form of dry cell By plaster is meant plaster of Paris This is bought dry and is stirred up with the other materials and the water when the cell is to be filled This makes a wet paste which while soft is rammed into the space between the zinc and the carbon When the plaster sets the whole is firm This formula is a reliable formula. We do not know any better although there are cheaper It is also to be found in SUPPLEMENT No 792 price ten cents

(12731) W T asks Two men circling a given point keeping the same distance from given point A moving on circle 4 feet from given point B moving on circle 3 feet from given point and always keeping given point between them After each has circled the point once has A circled or gone around B? A The problem of the men going around in a circle at different distances from the center and the question Do the men go around each other? is very old It has numerous forms The squirrel on a tree trunk and the hunter walking around the tree while the squirrel goes around the trunk is perhaps the most common The moon and the earth is exactly the same as you see Does the moon go around the earth and the earth go around the moon? Astronomers answer yes We have always answered all these questions Yes The answer depends upon the answer to the question What is meant by the phrase to go around? We answer that by saying that a person goes around another if he is at one time to the east of the other and in turn passes around him so that he is to the south west and north and finally is to the east of him again whether the other party has stood still or not then he has been around that other person Apply this to each of the two men in your case and if you accept our definition you can answer the question as well as we can for you If you do not agree with us upon the definition of going around we shall not agree upon the answer to your question There is no need of debate There is only need to agree upon the definition of the terms employed

(12732) C C asks 1 How much gas is produced by one pound of carbide? A One pound of carbide is rated to give 4 cubic feet of acetylene gas at normal pressure 2 How much from a gallon of gasoline? A The gas from gasoline as used in the gasoline engine is a mixture of gasoline vapor with common air Very roughly about 1 800 cubic feet of air-vapor mixture of proper composition to give good explosion power may be produced from a gallon of gasoline 3 How long does it take for the world s population to double itself? A It is not possible to give more than an estimate of the rate of increase for the inhabitants of the whole world, since a considerable fraction of the world s population has never been enumerated The population of the United States increased 21 per cent in both the last decade and the one preceding the last Figures can be given for the countries of Europe much of South America and for the British colonies. 4 Is there anything known that will double the yield from the land? A A better agriculture will increase our crops immensely We are by no means at the end of our resources in this respect We are just starting to learn how to farm See an article in SUPPLEMENT 1930 price ten cents entitled Plant Food in Relation to Soil Fertility in which there is much valuable information 5 If not is there enough new land to keep the increasing population and animals in the present standard of living till the middle of this century? A Untilled land does not bear so large a ratio to tilled land as to enable the increase of population to be provided for by bringing new land into cultivation for an indefinite period although the end of things is not so near as you state 6 Or does the world grow? I think it does, because if we add layers to a ball it must get bigger and are not the old cities forests, etc found deep down grown over by falling vegetable and other matter? And does that not explain why lakes and streams disappear? Are they not filled up by this matter as the earth grows, and the water sinks in to the earth? A The earth does not grow in the sense in which you seem to use the term. The materials which have covered forests, cities, etc are not additions to the earth from outside, but are simply the result of changes in the materials of the earth itself perhaps in the very neighborhood where they now are. Mountain sides are washed into the valleys by the streams, vegetable and animal forms grow [illegible] and decay, to be covered and forgotten, the sediments harden into new rock strata, a [illegible] [illegible]

which entered into them, all derived from the earthy matter already in existence before they were formed and still existent in the new forms.

(12733) F. R. asks: Please advise us why razors and other steel tools lose their edge and when laid aside without sharpening seem to regain their original keenness. There has been an old saying that a razor or certain other tools after being in use for some time get tired and if laid aside for a time take on courage and can be again successfully used without practically any sharpening. Is this really so? A. We have no knowledge whatever as to the regaining of its original sharpness by a razor which once dulled has been laid aside. Ours do not act in that way. We have to hone them again or send them away to be sharpened. The greater likelihood is that steel-edged tools will become dulled by rust if there is any chance of moisture being upon their surfaces when laid away. For this reason men are usually advised to hone their razors after shaving and before putting them into their cases so that the friction of honing may dry the edges and drive off the moisture which is certainly there after using them in the lather. We cannot say that we think your theory is really so.

(12734) G. M. asks: 1. Would you kindly notify through the columns of your paper the process by which I could take photographs on paper, the same to be used as a negative from which other prints are to be made? The pictures to be small but numerous. A. You can make negatives upon Velox and other developing papers just as positives are made. These negatives may be rendered semi-transparent by rubbing glycerine over the back and then they may be used for printing positives as other negatives on glass or celluloid are used. They will however probably show the grain or web of the paper in the positive and not be as satisfactory as negatives made upon a film of celluloid. The ordinary Kodak film or any other similar film is far better adapted to the purpose than paper and we would strongly advise against the use of paper unless you have some reason for its use which you do not state in your letter. 2. Could you also give the process by which pictures are transferred from paper to paper? I have seen a paste for doing this work but I am unable to get any information about same. A. We do not know any process for transferring photographs by means of a paste or other adhesive to another piece of paper. If the photograph be fixed upon a card or thick paper by glue or paste you may perhaps be able to wet the paper and rub it off with the finger as in some other transfer processes. You will find these given in our Scientific American Cyclopedia of Formulas, which we send for $5. We shall be pleased to receive your order for a copy. 3. Could you also give a process for fireproofing thin paper? A. Borax or alum may be dissolved and paper may be soaked in the solution and after drying will be slow burning, indeed will not burn with a flame, but we do not know any mode of rendering paper non-burning or completely uncombustible. The various methods are given in detail in our Cyclopedia of Formulas referred to above.

(12735) T. A. P. asks: What is the name of the largest sun in the visible universe and what is its diameter and mass? A. No one knows which is the largest star nor what its size may be. The distances of only about 20 stars out of about 125,000,000 in all are known to a certain degree of accuracy. Perhaps Arcturus is the star which suggested the inquiry to you. He is a giant among the stars about which we have the more knowledge and is described in our SUPPLEMENT No. 809. Other articles upon the same topic are to be found in the SUPPLEMENT Nos. 1474 and 1658, price ten cents each. We send you our SUPPLEMENT Catalogue, which will give you the topics of many papers which you will surely find of interest. We can supply any number mentioned in this catalogue at ten cents each.

(12736) J. B. M. asks: 1. Where can I obtain an explanation of the principle on which the stereoscope works, showing exactly how the rays of light operate to make the stereoscopic effect? A. Stereoscopic views are made by the use of a camera with two lenses as far apart as the eyes of a person. They are, therefore, the same as the views seen by the right and left eyes. These are mounted side by side on a card. The lenses of the stereoscope are as if cut from the sides of a larger lens and are therefore somewhat wedge-shaped. They bend the rays of light apart, each using only the light from its own view, and in such a manner that the eyes see the two views in the same place in front of the lenses combined into one view. The textbooks of physics, used in the schools and colleges, usually have a paragraph about this instrument, with a cut showing the paths of the rays of light. You will probably have no difficulty in finding the information in some textbook or encyclopedia in the public library of your city. 2. Do you know whether there has been any successful attempt to produce the stereoscopic effect on a screen so it can be viewed by an audience? A. The pictures of the stereoscope have been many times projected by two lanterns, one over the other, but [illegible]

NEW BOOKS, ETC.

THE COMPLETE YACHTSMAN. By D. Heckstall-Smith and Capt. E DuBoulay With 200 illustrations in the text and 24 plates. Size 5¼ × 8¾ in., 503 pp. Price, $3.75 net. New York Outing Publishing Company

It does not take an expert yachtsman to realize that within the half thousand pages of this volume must be contained an answer to the thousand-and-one questions which are liable to be asked by the yachtsman for his guidance and instruction in the noblest of all pastimes. The writer has had some knowledge and experience in the owning and sailing of boats and yachts and he did not need to read very far in the pages of this volume to realize that here was a most admirable and greatly needed work. The halftones are among the best that we have seen of notable yachts under full sail. Starting with the embryo yachtsman taking his first lesson in the rudiments of rowing and sailing the reader is carried throughout the whole range of the subject from open sailboats through the knockabout, the sloop, small and large to the two-masted schooner and is told more about their construction and handling than it is given to the average yachtsman to acquire in a lifetime As an instance of the high quality of the book and the extremely interesting way in which technical information is imparted we draw attention to Chapters 12 and 13 in which no less than forty pages are devoted to a detailed description of the varying fortunes of a race among first-class racing sloops over a thirty-mile triangular course. The many problems involved in the handling of a big racing cutter of the modern type are brought out in a most fascinating and readable way Many yachtsmen will feel that these two chapters alone are well worth the price of the book

AUS DER GESCHICHTE DER MENSCHLICHEN DUMMHEIT München Albert Langen, 1912.

Dr Kemmerich has written a book which is not only an interesting historical document but a most effective piece of satire, effective because it presents incontrovertible facts in a way that sets forth most tellingly the vanities the follies and the mean mistakes of mankind There is some crumb of comfort in the fact that since most of Dr Kemmerich s instances of human stupidity are taken from the Middle Ages, we can explain them away by arguing that they were the superstitious products of superstitious times and therefore hardly applicable to human beings of to-day We could wish therefore that Dr Kemmerich had given more modern examples of obstructions to progress. The whole literature of evolution for example, is replete with them To be sure in the latter portion of his book Dr Kemmerich does devote some space to modern superstitions. The devil he assures us, is still the object of much concern even in the year of grace 1912 Perhaps the most shining instance of modern stupidity is that of people who bury themselves alive in order to escape the census taker When we laid the book down we wondered whether it was not more a history of human insanity than of human stupidity

HANDBUCH FUER HEER UND FLOTTE Enzyklopaedie der Kriegswissenschaften und verwandter Gebiete Herausgegeben von Georg von Alten. Berlin Deutsches Verlagshaus Bong & Co , 1912.

Installments 49 and 50 of the ' Handbuch fuer Heer und Flotte cover the first part of the letter G The longest discussion to be found in these two installments is that which relates to fighting (*Gefecht*) A very compact and valuable review of old and modern methods of fighting both on land and sea is here presented Under General will be found much valuable information on such topics as General War Fund Lieutenant-General and other military titles in which the word General occurs. Of the geographical articles, that on Genoa is the most complete and therefore the most valuable.

TRIUMPHS AND WONDERS OF MODERN CHEMISTRY A Popular Treatise on Modern Chemistry and Its Marvels. Written in Non-Technical Language for General Readers and Students. By Geoffrey Martin. New York D Van Nostrand Company, 1911. 340 pp , 76 figures. Price, $2 net.

The sensational and the bizarre are attractive to most minds, it is very generally believed that to most minds they are injurious. It is no doubt because of these opposed reasons that the pronouncements of advanced scientific thinkers, reconnoitering beyond the outposts of learning, are read with avidity by the layman, and torn to pieces with equal avidity by scientists of more staid and sober thought. It is but seldom that a writer dealing with highly theoretical matters becomes neither a partisan nor an antagonist.

Into the realm of speculation, the reader is at once led by Mr Martin. The excursion is an interesting one, though a trifle bewildering, since billions are about the smallest numerical magnitudes dealt with. While we perhaps differ with the author's positiveness in stating that certain so-called molecular, atomic, and corpuscular conditions and relations are so, rather than that they are indicated to be so by more or less [illegible] evidence, we think his store of data collected, and his manner of presenting it, of interest and of value in showing the trend of modern experimentation and the speculation based upon it. While his applications of physico-chemical principles to the conditions of life on this earth show the wonderful inter-relation of [illegible]

and the language throughout is scholarly and exact. Occasionally there is a somewhat misleading lack of exhaustiveness, due beyond doubt to the author's desire to avoid confusing the reader unfamiliar with the detail of chemical knowledge. If any serious criticism is to be made, it is of the too frequent insertion of poetry in the body of the work Vague and inexact poetical expression can seldom be useful in illuminating accurate scientific concepts.

The book will be read with interest by chemists because it carries them beyond many familiar points the novice can read it because it will arouse his interest and hold his attention It is in no sense a systematic textbook it was not intended for one but rather a stimulus to the desire for systematic chemical study

THE CURTISS AVIATION BOOK By Glenn H Curtiss and Augustus Post. With Chapters by Capt Paul W Beck, U S A, Lieut Theodore G Ellyson, U S N, and Hugh Robinson New York Frederick A Stokes Company, 1912

Following the example of other designers and operators of flying machines Mr Curtiss has, with the able assistance of Mr Augustus Post, given us a very readable account of his life and of his rise as an inventor of aeroplanes. In reading this book one cannot fail to be struck by the fact that Mr Curtiss's experience in the building of motors for motorcycles and his record-breaking achievements as a motor-cyclist stood him in good stead as an apprenticeship for the career with which he was subsequently to become identified Of technical information the book contains very little for the very good reason that it was obviously written for the general public rather than for the constructor of flying machines. To our mind Mr Curtiss's principal contribution to the art of flying has been the development of the hydro-aeroplane To him more than to anyone else, we are indebted for a new type of air craft which promises to broaden the scope of flying and to place the aeroplane within the reach of those who would like to fly but only if it can be done with safety It is true that Fabre must also be considered a pioneer in this art but we believe we are correct in asserting that to Curtiss we owe the real flying boat It is therefore a pleasure to find that an appreciable portion of the book before us is devoted to Mr Curtiss's work with hydro-aeroplanes

NATURE'S HARMONIC UNITY A Treatise on its Relation to Proportional Form By Samuel Colman, N A Edited by C Arthur Coan, LL.B With 302 illustrations by the author New York G P Putnam's Sons, 1912 8vo, 323 pp Price, $3 50 net

The author's thorough and fascinating research discloses a marvelous harmony among those laws of Nature which govern proportional form Is it too much to suppose that the rules adopted by artists and architects among the ancients were based upon a close observation and a sympathetic interpretation of those natural laws as manifested in crystal in flower and in shell? Several interesting works tend to uphold this theory notably those of Prof A H Church of Oxford and Prof Raymond of Princeton University But no work has hitherto been issued which so graphically shows the connection between the laws of Nature and Art or which comes so near to a demonstration of the application of Nature's constructive principles to works of art While emphasizing the element of measurement in imaginative construction the author points out that while music is the most mathematical of all the arts yet it is also the one which leads the mind most persistently to the highest realms of imagination and emotion Poe said that poetry was one tenth ethical but that the other nine tenths of the art appertained to mathematics In the work in hand the illustrations have been planned and wrought out with great care The section on architecture is perhaps the most interesting both from the value of the applications therein made and the beauty of the illustration The relations between the proportional dimensions of a snow crystal and those of the Parthenon are strikingly shown Altogether the work is one of singular beauty and inspirational power

FRESH AIR AND HOW TO USE IT By Thomas Spees Carrington, M D New York The National Association for the Study and Prevention of Tuberculosis, 1912 8vo, 250 pp, illustrated Price, $1

HEALTH IN HOME AND TOWN By Bertha Millard Brown, S.B New York D C Heath & Co, 1912 8vo, 312 pp, illustrated Price, 60 cents

In this time of awakening to the advantages of outdoor life, and the growing prevalence of outdoor sleeping "Fresh Air and How to Use It" will appeal to a wide circle of readers. It contains chapters on ventilation, on wall houses and iron-frame porches for city use on permanent sleeping porches and loggias and the methods of protecting and screening them and on tents and tent houses. There are many illustrations, showing all manner of devices for securing fresh air, particularly during sleep The final chapter discusses clothing bedding, and furniture, with the various forms of sleeping bags and tent cots. "Health in Home and Town" is, as its title would indicate, a little broader in scope and a little less detailed in description. Besides the matter of securing fresh air both night and day it takes up such important features of our lives as running water in the home, methods of heating and lighting the care of the home, parks and playgrounds, food supply city water and ice, refuse, dangerous diseases, and the prevention of disease, particularly of tuberculosis. Both books may be commended to those who would improve the conditions of life and raise the standards of health and happiness.

"The Whip" and Its Mechanism

(Concluded from page 98.)

lar device is in use on the other side of the stage to give the effect of the exhaust of the automobile which is racing to save the life of the precious horse. The steam exhausts into a large packing box and the effect is very realistic. There are electric lights at intervals along the track which are flashing in succession, thus giving the effect of the light from the cars on the rails. A moving panorama at the back rounds out the illusion. The tunnel consists of a black cloth scene and it is set in semi-darkness by men who wear black smocks so they will not be seen by the audience. This is a variation of the well known trick called "Black Art." When the locomotive is pushed forward by the men propelling it, it is run up on an interrupted inclined plane. The slats which have been removed at the top of the plane leave an aperture which receives a false wheel in the center of the locomotive that throws it over to one side. The locomotive, which is built of wood, is piped so that steam comes out of the stack, fire box and underneath. At the moment of the crash a bomb is exploded in the box car and it is promptly broken by men who pull lines at a signal.

The scene gives an admirable idea of what English rolling stock really looks like from the inside, but the privileged few who have been taken behind the scenes and ridden in the coach (a much sought for privilege) will all concur in saying that there is no coach in England as hard and unyielding as is this theatrical property. It would almost appear preposterous to those who have not been abroad or have seen the play that an evil minded person could emerge from his compartment and creep along the footboard to work such mischief, but some of Europe's most atrocious crimes have taken place in railroad passenger carriages of this type.

"The Whip" was sent to Newmarket by another train and after strenuous unsuccessful attempts to prevent her being ridden by her own jockey, the actual race takes place. The stage has been cleared of scenery and those who have taken part in the mob scene gradually edge off to left and right. The stage is darkened for a moment, the curtain is raised, and the audience sees for a brief moment a most exciting race. There are eight horses in the race, but there is a chance for only two of them to win, as the others are held in position by iron rods which prevent them from actually progressing across the stage. In order to give a lifelike appearance they run on treadmills which are flush with the floor of the stage. The treadmills of "The Whip" and her nearest competitor are mounted on rollers and are adapted to move across the stage in a channel which is provided by removing sections of the flooring. Two men in the cellar receive a cue from a man who is watching the race through a hole in the floor, and at the proper signal they both turn their winches and at another signal the removable platform on which "The Whip" is speeding is drawn forward past the winning post, which is mounted on rollers and is pushed back at the critical moment by a man who stands behind it. He is masked by a black background which serves to bring out the winning post in relief. The panoramas which run in the opposite direction to the race are extremely ingenious. The large panorama is fixed and occupies the back of the stage and this is driven by a 35 horse-power motor in the cellar. The other four panoramas, however, which prevent a sharp line of demarkation, can be pushed around into position, and each of these four panoramas is actuated by its own motor. The five panoramas are all controlled through one switchboard so that they are all moved in unison.

The horse race on the stage is not a new thing by any means, the first of such devices being used many years ago in a melodrama called "Paris Port de Mer." Neil Burgess obtained a patent on the mechanism for accomplishing this effect and it was also used in "Ben Hur." It was found in "The Whip" that by sinking the treadmills so they are flush with the stage, it was not essential to run moving belts in front of the treadmills as was necessary even at Drury Lane. The idea of having the small portable panoramas is a very good one, as it adds a great deal to the realism.

It is very unusual to get permission to illustrate stage mechanism by actual photographs and we are indebted to the Drury Lane Company of America, its directors, William A. Brady, F. Ray Comstock, Morris Gest, and Mr. Arthur Collins of London, with whom special arrangements were made, and Mr. Ben H. Atwell, who conducted the negotiations.

The Mercy of Steel and the Menace of Wood

(Concluded from page 90.)

picture of those which we present in illustration No. X, showing a steel day coach after it had assisted in completely demolishing the two wooden cars to the rear and in front of it. This car passed through the frightful collision on the Delaware, Lackawanna and Western Railroad near East Corning, New York, on July 4th, 1912, when an express train, disregarding the distance and stop signals, crashed at sixty miles an hour into the rear of an express train ahead of it. The energy of the colliding train was expended mainly on the last three cars of the train ahead. The rear car was a wooden day coach, the next was a steel coach, and ahead of that was a wooden sleeping car of very strong construction. The flagman of the stalled train went back some two thousand feet from the rear of his train, put a lighted green fusee on the end of the tie on the engineman's side of the track, waved his flag, but did not, as he should have done, place any torpedoes on the rail as required by the rules during foggy or stormy weather. An eight-car express train running sixty miles an hour swept round a curve, disregarded the distance and home signals, the flagman's flag and the green fusee, and swept straight ahead. The engineer was busy with his injectors, which were out of order, and when he passed the flagman was observed to be looking not ahead but across the boiler. The rear wooden car, caught between the upper and nether millstones of the engine and the steel car, was reduced to matchwood, as shown in illustration No. IX. In acting as the anvil for this mighty blow of nearly 70,000 foot-tons the steel car suffered no worse injury at its after end than the crushing in of the platform. Driven forward by the impact, it reduced to unrecognizable wreckage no less than two thirds of the heavy sleeper ahead. In doing this it suffered the injury shown at the left end of the car in illustration X. Beyond the fracture of windows, the main body of the car, as can be seen from the photograph, is practically intact.

An automatic stop set 1,000 feet back from the home signal would have averted this wreck, in which 40 people were killed and 88 injured.

Summing up, then, we may say that the lessons taught by the accidents we have had under review are mainly three. First, the imperative necessity of changing the practice of our rail mills so as to absolutely eliminate rails that are piped or otherwise defective; second, the substitution, as quickly as financial and other conditions will allow, of steel for wooden cars; and, last, the universal adoption in connection with the present block signal system of the automatic stop.

A Fire-resisting Envelope.—Harry H. Jensen of Oakland, Cal., has patented, No. 1,046,467, an envelope-like receptacle which has a fire-proof layer and a finishing layer with a carbon sheet between such layers by which marks of identification produced upon the finishing layer may be transferred upon the fire-proof layer, so that in case the finishing layer and the transfer layer are destroyed, the identifying marks on the fire-proof layer of asbestos will serve for identification purposes.

The Mysteries of Artesian Wells

ARTESIAN basins, or the underground water supply which furnishes artesian wells with their constantly flowing streams sometimes spouting to a considerable height above the surface are often popularly referred to as subterranean rivers which are believed to flow at great depths eventually finding their way to the surface to feed some visible stream. Or they are thought to exist as great caverns or reservoirs deep down in the earth which if tapped by the drill furnish the tremendous flows of water which characterize some of our largest artesian wells—several hundred thousand and even in some cases half a million gallons a day. It is true that artesian waters are stored up in underground reservoirs but they are not of this character. Most artesian water supplies consist simply of water filled strata of sandstone or other porous rock material through which the water very slowly percolates confined from above and below by other strata of impervious rock or clay. Through this inclosed layer of porous rock the water works its way with infinite slowness following the dip or slant of the rock and where tapped coming to the surface if the surface at this point be below the source of the supply. Coarse sandstone is capable of holding a great quantity of water as much as 8 quarts per cubic foot but the rate of its movement through this rock is so slow as to be almost inappreciable.

To illustrate how slowly the water travels. Many artesian or flowing wells are found along the Potomac River at Colonial Beach and other points in Virginia about 60 miles south of Washington. This water is obtained by drilling into a sandstone formation which extends along the Potomac Valley and into Maryland and outcrops near Frederick, Maryland some 50 miles north of Washington. It takes about 100 years for the water of this subterranean river to flow that distance that is the rains falling upon the exposed portions of the porous rocks near Frederick sink in and move southward at the rate of about 1 mile a year. The water bubbling from the wells at Colonial Beach today fell as rain on the uplands and mountains of Maryland around about the time that Washington was President of the young American Republic.

Ozone as a Rapid Paint Dryer

PAINT drying has no connection with the evaporation of water. In fact the weight of the painted surface increases in drying. Paints are mixtures of insoluble pigments or coloring matters with some drying oil generally linseed. When exposed to the air the oil absorbs oxygen and is converted into a smooth elastic mass called linoxyn.

To hasten this drying process the oil is frequently boiled before mixing with the pigment. Lead oxide, manganese dioxide or metallic salts are added in the boiling process to start the drying or oxidation of the oil. The oxides give up their oxygen but the salts act as oxygen carriers. The most recent accelerator used in paint drying is a blast of ozonized air. Ozone is only a more active form of oxygen obtained by passing air through the silent discharge of a high voltage electric current leaping across a gap. Machines are on the market at a low price that furnish large quantities of ozonized air and the cost of operating is no more than for one or two sixteen candle power lamps. They are portable and easily attached to ordinary lighting circuits.

Since ozone oxidizes with enormously greater speed than oxygen its value in paint drying is evident. In the painting of automobile bodies hurried drying is demanded by the crowded condition of the factories. Recent tests with ozonized air showed after two hours an increase in weight of the painted body of 3.34 per cent, while with ordinary air the corresponding increase was only 1.51 per cent. This increase was due to the absorbed oxygen, and fairly measures the relative [illegible] of the two drying methods.

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The signal for a good smoke is FATIMA. All over America men who value quality recognize these wonderful Turkish blend cigarettes as "just a little better."
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Water Supply

¶ To meet the pressing demands of five million inhabitants, New York has been obliged to undertake the most stupendous aqueduct system in the history of the world.

¶ Hampered by its situation on a narrow strip of land that intrudes between New Jersey and Connecticut, this, the second largest city in the world, has had to look to the north, and the north only, for its supply of water.

¶ In the heart of the Catskills an entire valley has been swept bare and converted into a lake 40 miles in circumference.

¶ From this reservoir runs an enormous conduit that dips into valleys and under rivers, pierces mountains and bores through solid rock, 1100 feet beneath the Hudson River, to the Croton Reservoir.

¶ Thence down through the heart of the city, so far below the surface that the busy people above give no thought to the daily firing of tons of dynamite, the conduit is being gnawed through solid rock.

¶ Finally a pipe line extension will pass under the waters of the bay to Staten Island, 127 miles from the source in the Catskills.

¶ The whole marvelous story will be told in the Scientific American of March 1st.

¶ Price 15c at all newsstands.

SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVIII.] NUMBER 5.] NEW YORK, FEBRUARY 1, 1913. [15 CENTS A COPY $3.00 A YEAR

The Rock-removing Machinery of the Suez Canal

By Jacques Boyer

THE Suez Canal traverses a diversified country. Near Port Said it passes through argillaceous sand and a few large beds of more or less compact clay. The bed of Lake Timsah consists of a hard conglomerate of sand and limestone, between Lake Timsah and the Bitter Lakes occur loose sand, mixed with clay gravel and gypsum, and overlain by a layer of salt and other deposits left by ancient evaporation, finally, compact clay, marl, and sandy conglomerates alternate until the Red Sea is reached. No rock has yet been found except in the southern part of the canal between kilometer 85 and Suez. Here the outcrop of the rock is almost horizontal. It occupies an area of 300 000 square meters (3,229,200 square feet) in the bed of the canal. The rocks include limestone of greater or less hardness, calcareous and silicious conglomerates generally containing shells, red calcareous tufa, gypsum and alabaster. In general, the rock is of medium hardness, except in certain deposits of compact limestone and sandstone.

In the construction of the Suez Canal, the rocky portions were removed before the water was admitted. In 1884, when the company undertook the work of widening and deepening the canal, it became necessary to devise means of removing rock under water. The hardest rocks were shattered by submarine mines, and the softer ones were removed by apparatus composed of a battery of 10 steel rams, weighing 3.5 tons each, which were raised and let fall on the rock in the manner of pile drivers. These same were placed on a floating bucket dredge which removed the rock as it was broken.

Experience soon showed that the efficiency would be increased by separating the rock breakers from the dredge and placing them on special floats. Although this arrangement produced an appreciable improvement it still gave only a mediocre result because of the insufficiency in the weight of the breakers. From fourteen to sixteen blows per square meter were required to break up rock of medium hardness to a depth of ½ meter (20 inches).

In 1897, when it was decided to increase the depth of the canal to 9.5 meters (31 feet), the engineers of the company studied the question more thoroughly. They found that for the removal of rock under water, the method described above is more economical than drilling and blasting. Furthermore, the employment of explosives presents certain obstacles to the navigation of the canal. After each blast, for example, it is necessary to send down divers in order to make sure that the channel is not blocked by the shattered rock. The blasting method cannot be carried out on so regular a plan as the other, and it also involves the removal of an excessive quantity of rock in order to obtain the desired profile with certainty. A few years ago, therefore, the engineers definitely adopted a rock breaking apparatus provided with two spindle shaped rams of cast steel, 13.5 meters (44.3 feet) long and weighing 18 tons each. These rams terminate below in replaceable points of very hard steel. The two rams are placed a yard apart and are raised by powerful steam winches which operate almost instantaneously through very flexible steel cables permanently attached to the tops of the rams. By means of this arrangement it is possible to hoist the rams very rapidly and to regulate without difficulty the height of fall which ordinarily ranges from 5 to 10 feet. The two winches may be coupled in order to exert an exceptional effort upon a single ram which has become fixed in the rock.

The apparatus is mounted on a float 30.5 meters (100 feet) long 10.57 meters (34⅔ feet) wide and 2.44 meters (8 feet) deep, made entirely of Siemens Martin steel. The falling rams are guided by a frame of special construction which also carries the pulleys over which the cables run. The float is moved forward, backward and in any direction rapidly by means of a steam winch.

Fig. 1.—Fourteen ton rock-breaking ram

Fig. 2.—Placing in position the head of a rock breaking ram

Fig. 3.—Rock-breaking float at work on the Suez Canal.

This apparatus was put into service in 1902, and since a few improvements in detail have been made, it has operated perfectly and broken all kinds of rocks without difficulty. In 1908 a second apparatus was installed having two rams weighing 14 or 15 tons each and 15 meters (49 feet) long which operate to a depth of 12 or 13 meters (about 41 feet). As a rule, 132 blows are delivered in each working hour. The mean thickness of the layer of rock shattered is 0.8 meter (31½ inches). In these conditions the number of blows required to break a cubic meter of rock varies from one to forty according to the character of the rock. The average is about seven blows per cubic meter.

The output thus varies from 132 to 3.3 cubic meters (172.6 to 4.3 cubic yards) per hour with a mean value of 19 cubic meters (24.8 cubic yards) per hour.

Largest Embankment in Germany

AFTER eight years' strenuous work the Mauer embankment has been completed. This, the largest engineering monument of Silesia, and at the same time the biggest embankment in Germany is situated in the Bober Valley between Hirschberg and Lähn, at a widening of the river where the Bober describes a strong inflection.

The masonry dam has been erected on a rocky soil at about 60 feet depth, it is 106.8 feet in height and at the bottom of the river 164 feet in width and withstands a pressure of 440 920 000 pounds. The masonry on the side turned toward the water is provided with a cement coating reaching down to the ground, to prevent any water from penetrating into its interior.

The interior of the wall comprises shafts and galleries. It is at the surface 918.6 feet in length and 24 feet in width, and contains about 327 000 square yards of masonry. Being so exceptionally substantial the dam will, it is firmly believed, check the most dangerous of Silesian rivers.

Upward of the masonry dam an artificial lake 5.0 miles in length will be formed, the embankment controlling a precipitation area of 463.3 square miles. The artificial lake will be 600 acres in area and 153.8 feet in maximum depth.

This embankment will be utilized on a large scale for supplying power to a considerable district of Silesia. The huge power house stands close to the outside of the embankment wall and comprises four turbines each of 1 800 horse-power. As, however, this power house is connected with that of the Queis Valley embankment near Marklissa a total of 10 700 horse-power will be available which suffices to supply the whole district of Liegnitz with electricity for lighting and power purposes.

The embankment was inaugurated on the 16th of November in the presence of the Emperor.

Some Facts About Granite

GRANITE is two and two thirds times as heavy as water. Its specific gravity is 2.663. A cubic yard of granite weighs exactly three quarters of a ton. The strength of granite is tremendous, although the different granites vary greatly. Poor granites will withstand a pressure of 18,000 pounds to the square inch. Good, close-grained granite will withstand 30 000 pounds, but certain Wisconsin granites have withstood a crushing pressure of 43,973 pounds to the square inch—22 tons weight resting on a tiny cube of stone not much larger than a lump of sugar.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly the world's progress in scientific knowledge and industrial achievement.

A Fatal Blunder

By remitting the tolls to coastwise ships that pass through the Panama Canal Congress has dealt a death blow to American deep-sea shipping. Everyone who has studied the problem of the decadence of our Merchant Marine understands that it is due to certain economic conditions over which we have no control. It costs so much more to build American ships and so much more to run them that successful competition with foreign ships in the deep-sea carrying trade is out of the question. That is a fact which no one disputes. Also it cannot be disputed that if we are to regain our former position as a leading maritime nation some form of Government assistance is necessary. Call it what we will, whether subsidy, subvention, preferential duties or what not, it is not denied and cannot be denied that Federal aid must be forthcoming, at least in the early stages of the upbuilding of our Merchant Marine.

Unfortunately, and thanks to the persistent misrepresentations of the stump orator and the yellow journal, there is a country-wide, though unwarranted, distrust of any proposed legislation which involves the principle of Government aid. The idea has been widely disseminated and too widely believed that Government aid represents nothing more nor less than the transfer of funds from the public treasury to the private purse of individuals and corporations.

Now the fatality of this matter of remission of Canal tolls lies in this, that to remit these tolls to the already prosperous and highly protected coastwise shipping companies is to do exactly what the yellow press has said would be done in every measure that contemplated Government assistance to shipping. To remit the tolls will be to make a free gift of $1.20 a ton to shipping companies which are already flourishing under the protection of a rigid monopoly.

So then the first attempt of Congress to give assistance to shipping will be a glaring example of that very abuse of the excellent principle of Federal aid, of which the country, thanks to misrepresentation, is so greatly afraid. With this preposterous act before their eyes it is certain that the people of the United States will become more firmly settled than ever in their unfortunate prejudice against any attempt, however commendable, on the part of the Government to assist in the reconstruction of our Merchant Marine. Not only has Congress given assistance where it is not needed, but it has killed for a long time to come any hope of assistance being given where it is needed.

The Complete Eradication of Typhoid

A MEDICAL contemporary has asked us to say something on the subject of typhoid eradication by immunization, and we gladly present the salient facts of this very vital subject.

One of the most important steps in the march of medical science has been the recent successful work in the prevention of typhoid fever by the use of typhoid vaccine. It has been demonstrated that inoculation will enable an individual, or whole regiments of soldiers for that matter, to live in typhoid-infected districts with complete immunity. It is not yet demonstrated just how long immunity will last, but it is known that protection is assured for at least one year. Typhoid immunization is harmless and in most cases causes no inconvenience.

Now the hope of the complete eradication of typhoid fever lies in the fact that the typhoid organism does not remain alive for any great length of time in water or the soil, two of the principal sources of the spread of the disease. Repeated investigation has shown that the typhoid bacillus will remain alive in natural water only for a comparatively short time; furthermore there is no evidence that the germ will live in soil longer than in natural water. Hence for the perpetuation of typhoid contamination in a well or some other water supply there must be added, at comparatively short intervals, fresh typhoid bacilli from a case of typhoid fever or from a typhoid carrier.

Now here are two facts of supreme importance: for if typhoid germs "will not survive more than a few months when exposed to the elements during warm weather," as stated by the *Bacterial Therapist*, and if "immunized individuals cannot contract the disease for a year or more," it follows that by carrying out systematic immunization during the winter months, there would be so few typhoid cases the following summer that the disease would be practically eradicated.

If a general typhoid immunization were carried out by the concerted action of the health authorities of the various States for a few years, there is every reason to suppose that the terrible scourge of typhoid would be swept out of the country. The State laboratories could furnish the vaccine at comparatively little expense. Would the public submit to the practice of general immunization? Thanks to the present-day widespread knowledge on this general subject, and the public familiarity with the results obtained in controlling other diseases, we believe it would.

Is not general immunization well worth a trial?

Some of the Absurdities of the Proposed Compulsory License Legislation.

MUCH solicitude is evinced in the report of the Committee to whom the Oldfield Bill was referred for consideration, lest the existing patent laws "enable owners of patents to withdraw a large amount of personal property from the control of the States." The Committee declares: "Nothing is more fundamental in our government than the clearly marked line between the jurisdiction of the State and of the Federal courts." Nevertheless the Committee recommends a scheme of compulsory license which gives every Federal district court throughout the United States power to hale before it every patent owner (except original inventors) whose invention, for any reason whatsoever, has not come into use within three years after the issuance of the patent, to determine judicially the value of the invention and to compel the patent owner to grant to any competitor who asks it a license to use the invention upon such terms as the Court may fix. This would transform the seventy-two Federal district courts into "courts of patent commerce." To quote one of the witnesses before the Committee, "for patents may cover collar buttons and steamships, tooth brushes and transportation systems, toilet articles and safety appliances, telegraph systems and tools, garments and foodstuffs."

How can the Committee reconcile such a proposal with its professed abhorrence of anything that may "ignore and override the jurisdiction of the State courts"? Such a scheme of compulsory license will diminish the inventor's market, enable any strong competitor to crush his weak rivals, impede every patent owner in developing and introducing his invention, retard the patenting of inventions and discourage the large-scale inventions and industrial experimentations on which civilization depends for solving the problems of existence.

To insure the non-enforcement of license restrictions, the substitute Oldfield Bill seeks to enforce solely against patent owners a Draconian code of business practice which is not and never has been imposed on any other class of property owners. Litigation under the Sherman Anti-Trust Act turns frequently, if not generally, upon close questions of law. By a salutary result of the existing law, property involved in all such litigation that is not in transit does not become forfeited if a combination in restraint of trade is found to exist. The substitute Oldfield Bill, however, provides that, under such circumstances, property in the form of patents shall be forfeited, while all other forms of property shall remain unaffected. Under the provisions of the bill the vendor of any patented article becomes a criminal if he attempts to secure a year's business, as a condition of selling to a retailer, if he attempts to hold the retailer to his agreement to buy his patented goods, exclusively or to a certain extent, if he attempts to hold the retailer to his agreement, to maintain a standard price on the patented goods; if he licenses the use of a delicate patented machine on condition that it be used only with specially prepared supplies, or in continuity with specially adapted machinery necessary to insure perfect operation, if he licenses the use of a patented machine with the requirement that a minimum royalty shall be paid and that all or part of the licensee's work shall be done on the machine, if he attempts to limit the licensees' use of the patented machine to a certain class of goods or a certain character of work to the end that he may be free to license to others the exclusive use of his patented machine on other classes of goods or character of work, if the quality of his patented inventions is used to induce licensees to take his machines, either exclusively or in part, for all their needs, if he agrees with a retailer in a town to sell his patented goods to no one else in the same town or to sell to other retailers only on less favorable terms, in consideration of which the retailer shall push the sale of the goods; if he licenses the use of his patented invention to a licensee who, for instance, makes steam engines of 1,000 horse-power whom he charges a rate of royalty different from that charged a licensee making steam engines of less than 1,000 horse-power, or if he sells the patented goods in a particular territory at a price less than that at which he sells elsewhere.

Any of these transactions, which good morals and honorable business practice to-day and from time immemorial have always sanctioned, is made by the bill conclusive proof of the violation of the Sherman Anti-Trust Act. The fact that the transactions might reasonably be shown to have no tendency to restrain trade, cannot save the unlucky patent owner, for the bill expressly provides that "restraint shall be conclusively deemed to have been or to be unreasonable and to be a violation of the provisions of said act" (i. e., the Sherman Anti-Trust Act) as to any one guilty of these transactions. The penalty which the patent owner may suffer for sinning in the manner indicated is the forfeiture of his patents, a fine of $5,000 and a year's imprisonment, and a payment of three-fold damages and the costs of suit and attorneys' fees to anyone who comes in within three years thereafter and proves any damage.

Was it a twinge of misgiving concerning this whole attainder of business, or was it an exquisite malevolence toward the patent system in particular, that suggested the imposition of these penalties on patent owners only? For the substitute Oldfield Bill forbids only patent owners from doing these things, and expressly leaves the owners of every other form of property free. Unlucky patent owners caught in the mesh may reflect that if they had dealt only in unpatented goods, instead of wasting time and money in developing new inventions, which their patents published to the world to the end that in seventeen years the world may use them without cost, they could have avoided all their misfortunes. Is this the way by which Congress is supposed to promote the progress of science and useful arts?

Machinery on the Farm

MENTION farm machinery to the average man and immediately he sees in his mind's eye a picture of ingenious harvesters, reapers, and binders. Perhaps, too, he may think of the tractor engine to which so much space has lately been given in illustrated periodicals, both popular and technical. But only if he be a technically informed man is it likely that he will think at all of the stationary engine and its agricultural possibilities, although it may be confidently asserted that it plays an even bigger part in transferring from flesh and blood to iron and steel the burdensome work of tilling the soil and harvesting crops. On many American farms little engines may be found that vary in size from one and two horse-power to forty and sixty horse-power, and that are used for almost every imaginable purpose.

Just how extensive is this application of engines it is difficult to state with any degree of certainty. No accurate statistics are available to show the actual number of farm engines in use, but the number must be huge. For example, in 1911 three companies alone made upward of 100,000 engines ranging in size from two to fifteen horse-power. Eighty-seven manufacturers reported that they had sold since starting in business, 655,000 engines, while seventy-six firms reported early in 1912 that their requirements for the year were at least 705,000 engines. As nearly as we can determine, there are seven hundred and fifty manufacturers of gasoline and oil engines in the United States, and fully five hundred of these make a specialty of farm engines. Their output must be at least half a million engines a year.

It is safe to assume that there are about two million gasoline and oil engines on our farms at the present time—probably a conservative estimate. The number is being added to at the rate of about 500,000 annually. The average size of these engines is about seven horse-power.

Every one of the 6,361,000 farms in the United States needs one engine at least, and many of them need two or three engines. Even under present conditions profitable use can be made of from thirty to forty million gas engine horse-power on the farms of this country. Surely here is an opportunity ready to be grasped by the enterprising manufacturer.

Engineering

Railway Construction in 1912.—During the past year there was added to the railroads of this country less than 3,000 miles of new line, according to statistics compiled by *Railway Age Gazette*. This is 845 miles less than the average for the past nineteen years. On the other hand, the total mileage of new line, commenced but not completed, is greater than it has been for five years past. Our steam railroad system is fairly complete, and it is natural to look for a decrease in new construction as the years go by.

The Artesian Wells of Australia.—The artesian well is one of the most important sources of water supply in Australia—a continent which is by no means lavishly supplied with the snow- and glacier-fed rivers which are so abundant in this country. A government report states that in 1911, in the State of Queensland alone, there existed 785 artesian wells, whose total depth aggregated 334 miles. Of these, 113 were over 3,000 feet deep, and one of them had been carried to a depth of 5,045 feet. Two of these boreholes, alone, gave a combined outflow of nearly 15,000,000 gallons daily.

Elasticity of an Alloy Spring.—One of the most important developments in metallurgy of recent years is the success which has been obtained with the various new alloys. We have before us the record of a test made on a vanadium-steel, automobile spring, which measured 56½ inches between centers and had a camber of 8½ inches. The spring was deflected under a load of 1,150 pounds to a straight line, and then under a load of 5,800 pounds it was deflected 15 inches. Finally, pressure was applied until the spring was reversed to what was practically a circle, without showing any sign of fracture.

Peat-producer Gas.—Chief B. F. Haanel of the Fuel Testing Division of the Department of Mines, Ottawa, has reported that the peat-producer gas-power plant has proved its reliability, since operation may be continued for a week or longer without shutting down for cleaning or overhaul. A test plant has been run for 1,0 hours continuously, and the report states that in regular service it should not prove necessary to clean the pistons more than once in several months. The output of the producer is uniform, fires can be cleaned without interference with the engine, and any operator of intelligence can run the plant.

Four-gun Turrets.—According to the Paris correspondent of *The Navy*, the two French battleships A-7 and A-8 to be laid down in 1913 will carry twelve 13.5-inch guns in three four-gun turrets. Are not the French putting too many eggs in one basket? One successful penetration by a high-explosive shell might put four guns out of action at once. Against this is to be considered the accuracy of fire and the considerable reduction of weight both in mount and armor. Our own three-gun mount embodies, we understand, a combined sleeve for all guns and the three guns will be given the same training and elevation under the hand of one man.

Important Railroad Electrification.—The Secretary of the Interior may be premature in his belief that the electrification of all the transcontinental railways is at hand, but he is certainly justified in attaching great importance to the grant by the Government of permission for the Great Falls Power Company of Montana to transmit over the public domain the necessary power to electrify 450 miles of track of the main line of the Chicago, Milwaukee and Puget Sound Railway in Montana and Idaho. In respect of the length of track covered, this is by far the most important application of electric traction so far made to a steam railroad.

A Notable Railway Bridge.—In this age of notable construction, work which only a few years ago would have commanded world-wide attention, now is apt to attract not much more than local interest and comment. A case in point is the handsome railroad bridge of the cantilever type, which has been built by the Pittsburgh and Lake Erie Railroad Company over the Ohio River, at a point about twenty-five miles below Pittsburgh. The total length of the bridge between back walls is 1,800 feet. The main cantilever structure, which measures 1,409 feet between centers of end pins, consists of a 370-foot end span, two 320-foot anchor arm spans, and a main span of the great length of 769 feet, which is made up of two 242-foot arms and a 285-foot suspended center span.

Twenty-five Knot Battleships.—The persistency with which the new 25,000-ton battleships for the British Navy are credited with a specified speed of 25 knots, raises the question whether the Admiralty has determined to merge the battleship and the battle-cruiser into one—a logical, and as it seems to us, a very sensible decision. Water-tube boilers, superheated steam, and the steam turbine have combined to render possible battleship speeds which could not have been thought of a few years ago. Our Navy Department has never favored the battle-cruiser, believing that our limited appropriations should be put into the first fighting line exclusively. England sets the fashion in naval construction, but if she builds 25-knot battleships, will the rest of the powers follow such a radical change?

Science

The Divining Rod Problem.—We learn from Count v. Klinckowstroem that a Society for the Elucidation of the Problem of the Divining Rod has recently been formed in Germany. The society counts among its members many men of prominence in the engineering and other professions and represents a serious scientific effort to shed light on a much debated question.

Storm Signals of the World.—The English Meteorological Office has just published a revised edition of the brochure entitled "Provisional Summary of the Maritime Weather Signals at Present in Use in the Various Countries of the Globe," which exhibits the remarkable diversity of the signals in question and is a strong argument in favor of the adoption of a uniform code. Hereafter this publication will be revised and reissued annually as long as various codes are in use.

An Aeronautical Weather Station has been established at Bitterfeld, Germany, by a local firm engaged in the construction of aircraft, and has been placed under the direction of a competent meteorologist, Dr. H. Rotzoll. Information for prospective travelers in the air is furnished on the basis of the twice-daily telegrams of the Deutsche Seewarte, at Hamburg, and whenever necessary pilot-balloons are sent up to ascertain the direction and force of the air currents over Bitterfeld.

A Great Collection of Hebrew Literature.—The last report of the Librarian of Congress contains an account of the Deinard collection of Hebraica presented to the national library last year by Mr. Jacob H. Schiff, of New York. This collection was brought together during many years by Ephraim Deinard of Arlington, N. J., and numbers 9,936 volumes and pamphlets, which cover a period of nearly three and a half millenniums, from the beginning of Hebrew national life to the present day. It is naturally very strong in biblical and rabbinical literature. "It forms," says the report in question, "an admirable beginning of a department of Semitica in the library, which the librarian hopes will develop into one worthy of the national library of a country in which the Semitic race is playing so important a role."

Using the Philippine Scouts to Fight Rinderpest.—The Veterinary Division of the Philippine Bureau of Agriculture is waging an energetic campaign against rinderpest, a disease which in former years destroyed annually upward of half a million cattle and carabaos in the Philippines, though the number has now been reduced to two or three thousand. A unique feature of this campaign is the extensive use made of the Philippine Scouts in searching for cases of the disease and also in patrol duty to prevent the introduction of infected cattle in regions where the disease has been stamped out. Last year a cordon of about 1,400 scouts gradually pushed southward as far as southern Pampanga and northern Bulacan, leaving the territory behind them free from rinderpest. About 150 of the Philippine Constabulary were utilized in the same undertaking.

A Novel Explanation of Glacial Periods was propounded by Prof. W. J. Humphreys, of the Weather Bureau, at the Cleveland meeting of the Astronomical and Astrophysical Society of America. Several times in recent years it has been observed that great explosive volcanic eruptions (Krakatoa, Pele, Katmai) by charging the upper atmosphere in the isothermal region with fine dust, have markedly diminished the amount of solar radiation received at the earth's surface. It seems evident that the effect of this process must be to reduce the temperature of the air near the earth, since the dust scatters a much greater amount of the solar radiation received from without than of the terrestrial radiation received from within, owing to the greater average wave-length of the latter. Thus a period of excessive volcanic activity if long continued would produce the thermal conditions of an ice age. The geological record furnishes evidence that such a period actually began shortly before the last ice age and has continued with diminishing intensity to the present time.

A New Idea in Storm Signals is now being actively discussed in the meteorological world. Heretofore various forms of flags, cones, drums, lanterns, etc., have been used to warn seamen that a storm is in prospect at the place where the signal is displayed, together with information as to the direction from which the wind is expected to blow in the same locality. These signals are well adapted for use in temperate latitudes, where storms are of great area. In the case of tropical cyclones, however, such as the West India hurricanes and the typhoons of the Far East, they do not give all the information desirable. If a vessel is about to leave port in these regions, the master wishes chiefly to know whether he is likely to encounter a cyclone along his route. A system of signals has been devised by Rev. L. Froc, director of the Zikawei Observatory near Shanghai, and is now in use experimentally on the China coast, which gives notice of the occurrence of a cyclone anywhere over the adjacent seas, together with its probable course. The International Meteorological Committee is considering the adoption of a uniform code of such "non-local" storm signals for use in all tropical countries.

Automobile

International Test for Motor Sleighs.—The Imperial Automobile Club of Russia has organized an international test for motor sleighs to take place in the environs of St. Petersburg on January 19th. The trials will include driving over five versts of snow-covered road and three versts of loose, untrodden snow. The first three of each trial will then compete in a special speed trial over both courses.

Acetylene Tank for Horse Wagons.—Partly with the idea of making the roads safer for the automobiles and their owners—who, of course, are the best customers of acetylene gas tank makers—one of the largest of these companies has brought out a miniature tank for use on horse-drawn wagons. The installation is similar to that on automobiles, the only difference being the size and number of the lamps required. One charging of such a tank will last for fully a month of ordinary daily use.

Rotary Motor for Automobiles.—While the rotary gasoline motor has proven a decided success in aviation, its use in automobiles has met with very little encouragement so far. Several systems have been given trials, but little has come of the attempts to adapt them for automobile use. The latest of them is the product of two Dutchmen who are at present in this country endeavoring to enlist the help of some of the large manufacturers. The motor is of the four-cylinder, two-cycle type, and so simple that the complete car, it is claimed, can be built for $400.

Carrying Motorcycles on an Automobile.—The new automobiles ordered by the German government have been fitted with "side pockets" large enough to accommodate two motorcycles, and have given a good account of themselves in the recent maneuvers. Entrance to the tonneau is effected from the rear and the running boards of the automobile are utilized as storage spaces. The particular advantage of this arrangement is that, as long as the car is running well, the cycles are out of sight and do not interfere with the free movement of the passengers. Should anything happen to put the car temporarily out of position, no delay would occur in the delivery of messages, as the motorcycles would be immediately made ready and mounted by two members of the automobile crew.

Selling Polish at a Show.—Some of the exhibitors at the recent London automobile show were ingenious to say the least, and one of them chose a novel means to keep his product in the public eye, or rather memory. At the stand in question metal polish was exhibited and samples were distributed. A man at one end offered small sample cans, but he was standing on a metal platform connected with a small induction coil. Those who stretched forth eager hands for the samples received a gentle jolt. Those who were eager enough for a sample and who could overcome their timidity were presented with them from the other man, minus the shock. The theory of the game was that it set people thinking. They remembered the shock and the remembrance brought to mind that particular brand of metal polish. Some time or other the recollection led to a test of the polish. The remainder is obvious.

$10,000 Prize for New Motor Fuel.—In order to encourage inventors and chemists, the British Society of Motor Manufacturers and Traders has offered a prize of $10,000 for a volatile fuel suitable for use in internal combustion engines. The only restriction in awarding the prize is the requirement that all the raw material or ingredients be obtainable in the United Kingdom in large quantities, so as to make Great Britain independent of other countries in so far as motor fuel is concerned, and that the fuel can be manufactured at a commercial price. The offer is the direct outcome of the present agitation for the improvement of carbureting devices and the alarming increase in the price of gasoline. The value of the prize itself is, of course, very small when compared with the enormous royalties to be derived from a truly satisfactory process of producing the desirable hydrocarbons. It is merely an encouragement in investigation.

Curing the Smoke Evil.—With the practical necessity for eliminating the smoke nuisance and the efforts of very nearly every engine manufacturer turned in that direction, some tests recently conducted by the Royal Experiment Station for Testing Materials at Berlin are interesting. A sample of commercial motor lubricating oil was separated into two portions, one portion being treated with acetone, which dissolved the heavier constituents without impairing the lubricating value of the oil, and the other was tested in its normal condition. The results of the tests demonstrated that the "treated" oil was an efficacious lubricant and that it burned without producing either smoke or irritating odors. The normal oil, on the other hand, burned, emitted considerable volumes of smoke and an odor described as "highly irritating to the nose and eyes." The tests suggest that methods in vogue to abate the smoke nuisance are perhaps directed wrongly, and that chemical rather than mechanical means might better be employed.

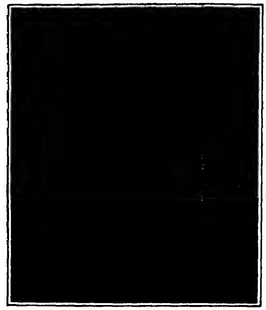
Finding the protein present in grain by the Kjeldahl method.

Soil Analysis and Seed Selection

A New Problem in Agriculture

By L. V. Redman
Department of Industrial Chemistry of the University of Kansas

The chemist in agriculture is concerned with two main problems. The first deals with the composition of the soil and the availability for plant life of its constituents. The second has to do with the selection of seed according to its chemical composition with the object in view of obtaining, not a greater number of bushels of grain per acre, but a greater yield per acre of any one chemical constituent contained in the grain. This latter problem, the application of the law of natural selection to the increase in yield of any one chemical compound present in grain, is new and inviting.—EDITOR.



An hydraulic hand press of 100,000 pounds for expressing oils, waxes, etc.

NITROGEN, phosphorus, potash and lime are the four "critical" constituents which every soil must contain if it is to be productive and a chemical analysis reveals their presence or absence. A good soil to be termed rich must contain at least 0.4 per cent of soluble potash, 0.25 per cent of phosphoric acid, 1.0 per cent soluble lime and 0.25 per cent of soluble nitrogen compounds. The other chemical elements which make up the bulk of all soils are generally present in large proportions, and considerable variation in the amount of these elements present is not critical. An analysis reveals the constituents of the soil and the amount of each element present, but does not always give in a satisfactory manner the availability for plant food of the four critical elements. The reason for this lies in the fact that it is almost impossible to imitate faithfully the solvent action in the plant cell. No solvent has been discovered which will duplicate the conditions found in the growing cell of a plant. Dilute citric acid is the best single solvent for the purpose, although dilute hydrochloric and nitric acids are largely used by the chemists in this country.

When the chemist has determined the constituents present in any soil he must further determine their availability. The constituent potash will serve to illustrate further the meaning of "availability." If potash is present in the soil as a constituent of the rock feldspar it is "locked up" or not available, for the feldspar is practically insoluble. However, if the soil be treated with land plaster or gypsum, the potash is changed into the sulphate of potash and is readily soluble and available for plant food.

And although a chemical analysis is not as comprehensive as one could wish for, yet sufficient valuable practical data can always be obtained by the chemist to repay the cost of the analysis many times over.

Influencing the Composition of Seed by Natural Selection.

A chemical problem which bids fair to outclass others in importance is the selection for sowing of seed according to its chemical composition. The law of natural selection which is being applied with wonderful success to the improvement of races of domestic animals, and also to the gross yield per acre in grain production may be applied with equal success to the problem of producing grain which has a more desirable composition chemically than the existing varieties.

To illustrate this point further all grain is composed of three classes of chemical compounds, fats or oils, proteins and carbohydrates (carbohydrates are sugars and starches). The oils, fats, sugars and starches supply heat and muscular energy to the body. The proteins build up the muscles and nervous tissue, and all mental processes are concerned directly with the breaking down of protein in some form. Proteins are the building materials of muscles and tissues, and the fuel of the brain and nerves, just as fats and carbohydrates are the materials for heat supply to the body. Any grain therefore which can be produced which will contain larger percentages of proteins than the existing varieties will serve two purposes. It will have a larger muscle-building value and nerve value, and its heating properties will be reduced. This is of considerable importance when one recollects that most grains, such as wheat and oats used in the form of bread or as a regular cereal are at least fifty per cent too low in protein for the best support of the individual. The fat and heat producing factors are consequently fifty per cent too high. In corn alone the protein is one hundred per cent too low. Consequently, all cereal diets must be supplemented with meats which are very largely protein. If the protein content can be increased one hundred to two hundred per cent in grains, cereals could safely supplant a large part of our meat diets.

With these facts in mind it is evident that any research work which will increase the percentage of protein per bushel of grain will be of great value.

Some pioneer work in this direction has already been done by chemists. For example at the Government Agricultural Experiment Station in the University of Illinois, there has been developed four distinct "strains" of corn, all from the same original seed. The first strain has forty per cent more protein than the original grain. The second strain has twenty-five per cent less protein than the original. The third strain contains sixty-five per cent more oil than the parent corn, and the fourth contains fifty-five per cent less oil. These changes have been accomplished by ten years of selection based upon chemical analysis.

What changes may be brought about in ten more years or half a century of selection is impossible to predict. A much needed improvement in the muscle and nerve value of our ordinary grains may be hoped for, and a corresponding increase in muscle and nerve energy in the life supported on these cereals.

Atmospheric Ozone Up to Date

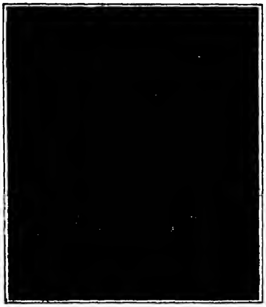
ARTIFICIALLY generated ozone has attained a prominent position in technology, and is daily being put to new uses. What of natural ozone that which occurs spontaneously in the atmosphere? Half a century ago this substance was regarded as nature's great scavenger. Then, and for many years thereafter it was a commonplace that an abundance of ozone in the air betokened a healthful climate. "Ozone" was a word to conjure with and figured conspicuously in the advertisements of health resorts. The air of forests, of mountains, of the sea, was supposed to owe its bracing effects to this gas. The degree of ozonization of the air was tested by the rate of change of some easily oxidized substance, especially the ozone papers devised by Schönbein and variously modified by subsequent authorities.

A deplorable amount of care and labor has been wasted on ozonometric observations according to the traditional methods, which are still kept up by certain meteorologists and hygienists. It has long been known that the so-called ozone reaction indicated by the coloration of test papers, is due partly and perhaps entirely to other oxidizing agents in the atmosphere, such as the oxides of nitrogen, hydrogen peroxide and chlorine. Moreover no allowance is generally made for the varying strength of the wind (with corresponding variations in the amount of air passing over the test papers), the hygroscopic action of the papers, and various other sources of error.

Chemists have made quantitative determinations of the ozone present in a given volume of air with remarkably discordant results. In reference books it is commonly stated, on the authority of Houzeau, that country air, 6 feet above the ground, contains on an average 1/700,000 ozone by volume. This amount would be perceptible to the olfactories, and Houzeau's estimate supports the popular belief that "ozone-bearing air" can be detected by its smell. On the contrary, Ilosvay (*Bull. Soc. Chim. de Paris*, 1889) was unable to find any certain evidence of the presence of either ozone or hydrogen peroxide in the air, but found on the other hand that all the so-called observations of ozone with test paper probably relate to nitrous acid. More recently, Hayhurst and Pring (*Trans. Chem. Soc.*, 1910) made a great number of tests at various altitudes, with the aid of kites and balloons, and found that in every case the amount of ozone was too small to be detected, i. e., less than 1 part in 4,000,000,000 parts of air, up to 8,000 feet above the ground, while at greater altitudes, up to 10 miles, the amount increased but still remained very small.

Ozone is produced in the lower atmosphere by lightning discharges and possibly by other agencies, but probably enters immediately into chemical union with oxidizable substances and therefore has but a momentary existence. The old idea that it is more or less permanently present in regions of the atmosphere inhabited by man and that its fluctuations are of hygienic importance is hardly tenable at the present day.

Nevertheless ozone exists in the atmosphere and is beginning to be looked upon as a meteorological element of great significance. It is formed from oxygen by electrical discharges and by the action of ultra violet light, and most actively when the gas is dry and cold. It is therefore reasonable to suppose that it occurs most abundantly in the upper atmosphere, miles above the earth, where the amount of ultra violet radiation from the sun is much greater than in the lower air, where there are frequent discharges of electricity in the form of the aurora, moisture is almost *nil*, and the temperature is very low. The solar spectrum always shows strong ozone absorption bands, proving that somewhere in the atmosphere ozone is permanently present. The blue color of the sky may be due partly to ozone. However, probably the most important function of the so-called "ozone blanket" of the upper air is its selective absorption in the thermal part of the spectrum, in virtue of which it lets solar radiation in much more readily than it lets terrestrial radiation out. (See SCIENTIFIC AMERICAN, August 6th, 1910, p. 107.)



Weighing large samples in chemical soil analysis.

Increasing the Food Supply of a Nation

How Intensive Farming is Practised in Germany

By Homer C. Price, Dean of the College of Agriculture, Ohio State University

A NATION'S food supply may be increased either by increasing the area cultivated or by increasing the yield per acre. In America we have been using the former method, and in Germany the latter method has been used. Within twenty years the cultivated area of grains in Germany has not increased over 5 per cent, but within this time the total product has increased over 60 per cent, due to the increased yield per acre. This increase has been due to the application of science to the practice of agriculture and has resulted from a better cultivation and handling of the soil, from the more abundant and intelligent use of stable manures and commercial fertilizers and from the selection and breeding of more productive varieties of crops.

A comparison of yields between single years is of little value because one year the crop may be abnormal due to an unusual season, but by taking an average for a period of years a representative yield is given that is a safe basis for comparison. In taking the government statistics of Germany and making a comparison between the average yields for the ten years from 1883 to 1892 and for the five years from 1906 to 1910 they show that the following increases in crop yields have been secured by the German farmers within twenty years:

INCREASE IN YIELD IN FARM CROPS OF GERMANY IN TWENTY YEARS

	Average Yield Per Acre		
	Period 1886-1895	Period 1906-1910	Increase in
Crop	bushels	bushels	20 years
Wheat	21.2	31.2	47.8%
Rye	16.5	28.1	70.0%
Oats	34.1	57.5	68.6%
Barley	24.5	37.2	51.8%
Potatoes	130.0	210.1	61.6%

Practically the same figures for the United States present a very different picture. Our yields are not only in most cases less than one half what they are in Germany, but the percentage of increase has been very much less as shown by the following table:

INCREASE IN YIELD IN FARM CROPS OF UNITED STATES IN EIGHTEEN YEARS

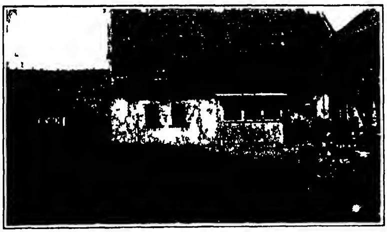
	Average Yield Per Acre		
	Period 1886-1895	Period 1906-1910	Increase in
Crop	bushels	bushels	18 years
Wheat	12.7	14.7	15.7%
Rye	12.7	16.4	29.2%
Oats	25.6	29.0	13.3%
Barley	22.6	24.6	8.8%
Potatoes	74.2	96.9	32.1%

While the yield of wheat per acre in Germany has increased 47.8 per cent in twenty years, in the United States it has increased only 15.7 per cent, notwithstanding the fact that the yield in Germany is over twice as great as in America. A comparison of the tables will show that what is true of the wheat crop is true of the other crop yields. The German farmer is not only producing much more on the same area, but he is increasing his yield much more rapidly than the American farmer. And yet the German farmer has not reached his limit by any means, and one of the leading German agricultural authorities, Prof. Wohltmann, said recently that he was confident the German farmers could increase their present yields 40 per cent within the next twenty years. However this may be, it can at least be pointed out that the German crop yields are constantly increasing from year to year, and as yet there is no tendency to go back or even stand still.

What has made this rapid increase and why are the yields so much greater than in America? is the question that naturally arises. Primarily it is due to more intensive systems of farming, and certainly not to land that is naturally more fertile than in America. The German farmer spends much more labor and capital in the growing of his crops than the American farmer.

Harvesting the kind of crops that make Germany independent

A typical German harvesting scene



Courtyard of a German farmhouse

Center of operations on a German farm

His fields are prepared so that they look like a garden and the soil is in fine condition before the crop is planted. He is more careful in the selection of his seed and his stand of the crop on the ground is more perfect. He has also learned how to feed his crops with fertilizers. In the first place he scrupulously saves every bit of waste on the farm and returns it to the land. Stable manures are carefully preserved and then generously supplemented with commercial fertilizers. The German farmer has learned how to use commercial fertilizers, and he knows they are not to be used to replace stable manures but only to supplement them. He has also learned the necessity of keeping his land filled with humus to make it crumbly so that it is easy to cultivate and will hold rain water that falls on it. He does this by growing alfalfa and legumes, by plowing under green crops and by the use of stable manures.

But back of all this are two causes that are fundamental. First, the active and effective work that the German government has done to develop agriculture. The European nations shape their policies on a war footing and the standard of efficiency sought is to be able to produce their own food supply in case of war. England long ago staked her security in her navy and sacrificed her agriculture to manufacturing and commerce and gave up as hopeless the producing of her own food supply.

Germany together with the other continental nations has maintained high protective tariffs on agricultural products and accepted it as a fundamental problem of national existence to produce in so far as possible her own food supply.

As a consequence an excellent system of agricultural education has been developed and an extensive system of scientific research through agricultural experiment stations is maintained. The governments of both individual States and the general government make generous appropriations for the development of agriculture, all looking toward the one goal—feeding the nation. Chambers of agriculture have been established in the separate provinces and are wielding a tremendous influence in the agriculture of the country. They not only look after the ordinary administrative affairs such as the enforcement of inspection laws, but they are actively engaged in promoting the business interests of farmers through the organizing of co-operative societies, distributing the immigrant labor and every agency that promises to advance the interest of agriculture.

The second fundamental cause of the rapid development of German agriculture has been the efficient business organizations that the farmers have perfected along co-operative lines. This is particularly true in regard to credit. Intensive farming cannot be developed without an abundant expenditure of working capital, and before the American farmer can increase his yields per acre to anything near what the German farmer has done he must have capital that can be secured much more easily and at a much lower rate of interest than is the case at the present time.

German farmers through their land mortgage associations are carrying at the present time over one billion dollars in farm loans and they do not pay over 4 per cent interest for any of it and in many cases not over 3 per cent. There are also over 16,000 rural banks in Germany that are co-operative farmers' organizations owned and operated by the farmers and having deposits of $-,500,000,000. Through these institutions the farmers secure loans for working capital on as favorable terms as is secured by any industrial class. The length of time for which the loan is made and the terms of repayment are adjusted to meet the requirements of agriculture, and in this way the German farmer has a great advantage over the American who almost invariably does his business on too little working capital.

The pessimist who predicts the rapidly approaching time when the farmers of the United States will not be able to produce enough for our own needs, overlooks the possibility of increasing the production from our present area as Germany has done. There is no reason why America cannot do equally as well if

not better He also overlooks the possibility of adding to our present area by reclaiming our waste lands. The United States Geological Survey estimates there are 100,000 square miles of swamp land in the United States that can be reclaimed by drainage, and in the reclaiming of the arid lands by irrigation we have made but a beginning The population of the United States may continue to increase for generations at its present rate and American farmers will be able to produce our own food supply if we foster and provide for our agriculture as do the leading European nations.

The Rise of Agricultural Meteorology

HOW much does unfavorable weather cost the farmer? To what extent is the loss from this cause preventable? Is it not time that meteorologists, plant physiologists and practical husbandmen joined forces in an effort to find out more about the relations between weather and crops?

We cannot alter the weather - the opinion of Sunday Supplement vagarists to the contrary notwithstanding. We cannot temper the wind to the shorn lamb, but—may not the shearing be circumstanced to fit the wind? A thousand acts in our daily life represent so many ways in which we adjust our affairs to the immutable laws of nature The secret of mitigating the loss which weather - and climate which is weather in the aggregate inflicts upon the crops is *adjustment of the plant to its atmospheric environment* This may be accomplished especially in two ways first by the selection of varieties best fitted to the climate, and, second, by planting at such a time that the successive epochs of the plant's life will be most likely to coincide with suitable conditions of temperature, moisture and the like It is true that unseasonable weather will sometimes occur and defeat our best laid plans but in the long run the farmer who times his operations to agree with the normal march of the seasons in his locality will other things being equal, get the most out of his land However, before such a plan can be put into effect we must find out a great deal more than is now known about the meteorological requirements of every species and variety of domesticated plant This is the task of the agricultural meteorologist Meanwhile his colleague the physical meteorologist must aid the cause by carrying out detailed climatic surveys of agricultural lands. Intensive climatology is still in its infancy, and conventional climatic statistics are of comparatively little value to the agriculturist because they ignore local features.

There are many indications that agricultural meteorology is at last coming into its own A notable conference on this subject was held at the last meeting of the British Association for the Advancement of Science An International Commission on Agricultural Meteorology recently appointed by the International Meteorological Committee, held its first session in Paris last September Most important of all the International Meteorological Committee itself, which embraces in its membership the directors of the principal national weather services of the world, will hold a conference on agricultural meteorology at its triennial meeting in Rome next April The International Institute of Agriculture with headquarters in Rome is deeply interested in this subject and has recently published a report showing just what the existing meteorological services *of the world are doing for agriculture* With the recent agitation of the subject centers in the Old World it has spread to our own country and only a few weeks ago the Chief of the United States Weather Bureau assembled a number of his lieutenants at Atlanta to consider what steps should be taken for promoting closer relations between that Bureau and the agricultural colleges and experiment stations

Of all the investigations hitherto undertaken in the scientific borderland between meteorology and agriculture the most grandiose are those now being carried on by the Russian government under the direction of Prof P I Bronnov About 150 stations, scattered over the empire have been specially equipped for such investigations. Each station comprises small plots of land on which a certain succession of crops is grown year after year and meteorological instruments are installed in immediate proximity thereto, in order that strictly parallel observations may be made upon the crops and the weather The most important fact revealed by these experiments is the existence of certain critical periods in the life-history of each plant when the character of the weather markedly affects the yield In other words, the total amount of heat, sunshine rain and so forth received by the plant during the whole period of growth are much less important than the occurrence of definite amounts at certain times. In this respect each species and each variety has its special requirements and up to the present only the principal staples have been studied in detail Already however Russian farmers have become impressed with the expediency of consulting Prof. Bronnov and his staff about the choice of crops and the best time to plant

The farmer lives by the weather, and it behooves him to know as much about it as science can teach him It is passing strange that there are many agricultural colleges at which no course is offered in meteorology Strangest of all—while there are many excellent treatises on marine meteorology, and medical meteorology, and even aeronautical meteorology, an adequate work on agricultural meteorology has yet to be written.

"Myriawatt" a New Unit of Power

THERE is no difference in the measure of power whether produced electrically or by steam, by wind or by water There is absolutely no reason for holding to the old unit 'horse-power,' based on the power of an impossibly strong horse, when we have the "watt" based on the rational centimeter-gramme-second system, merely because the former is commonly associated with mechanical power and the latter with electrical power Logically the name of Watt should be more closely associated with steam than with electricity The term horse-power is falling into disuse among electrical engineers. It is so much easier to rate the power of an engine which drives a generator in terms of kilowatts. In fact, with direct connected engines and generators, it is very difficult to separate the mechanical energy from the electrical energy

But before the engineer can rid himself entirely of the old arbitrary units, there is still to be abolished a unit that *is even more senseless than horse-power for* the reason that the name is practically the same, and yet the value is entirely different. Ever since 1876, when the unit was adopted at the Centennial Exposition, boilers have been rated in boiler horse-power It is defined as the capacity for evaporating 30 pounds of water from 100 deg Fahr temperature of feed water to steam of 70 pounds gage pressure When this unit and the common horse-power unit are both reduced to the common standard of the British thermal unit, we find that the boiler horse-power is thirteen times that of the common horse-power Clearly then boiler horse-power is a misleading term and has no real reason for existing In an effort to get rid of 'horse-power' entirely a paper was recently presented to the American Institute of Electrical Engineers by H D Stott and Haylett O'Neill suggesting that the term 'myriawatt" be used instead The term is derived from the Greek "myria," meaning ten thousand and the term "watt' One boiler horse-power very nearly equals ten kilowatts or ten thousand watts Hence 'myriawatt In terms of British thermal units, one kilowatt is equal to 3,415 units per hour and one boiler horse-power to 33,475 units per hour A 'myriawatt' would then be 34,150 British thermal units per hour or only two per cent more than the boiler horse-power It is the common practice to rate water tube boilers at one boiler horse power per ten square feet of heating surface As this is an arbitrary measure, no harm can be done by increasing the unit two per cent, and boilers might hereafter be rated at one 'myriawatt" per ten square feet of heating surface.

At a joint meeting of the Standard Committee of the American Institute of Electrical Engineers, and a special committee appointed by the American Society of Mechanical Engineers, the new term was recommended and Mr C O Mailloux was appointed to present this unit to the International Electro-Technical Commission at Zürich It seems quite probable that the term will be adopted abroad, where 'boiler horse-power' is never used, and no suitable substitute exists.

The new term permits the use of a simple system of determining the over all efficiency of a plant. For it is only necessary to divide the kilowatt output by the myriawatt and multiply by ten to obtain the per cent of efficiency The input of a plant and its output need no longer be stated in different and unrelated units of power All power can be measured in terms of a single unit. Blessed is the man who makes one word grow where two words grew before

Teisserenc de Bort (1855–1913)

AMERICAN meteorologists thought of the late Léon Teisserenc de Bort as "the French Rotch," and of the late A. Lawrence Rotch as "the American Teisserenc de Bort" Both men enjoyed ample private fortunes and were generous patrons of meteorology; each of them built and directed a private meteorological observatory, and each was the great pioneer aerologist of his country This parallel has unhappily been completed by the death of both in middle life, and within a few months of each other

Teisserenc de Bort was born in Paris, November 5th, 1855. From 1878 to 1892 he held an active position, and from the latter year onward an honorary position, on the staff of the Central Meteorological Bureau of France. In 1896 he founded his observatory of dynamical meteorology at Trappes, not far from Paris, and here he began about 1898 the series of sounding-balloon ascensions which led to the astonishing discovery of the isothermal layer of the atmosphere—first formally announced to the French Academy of Sciences in 1902. Twentieth century meteorology may be said to date from this achievement, as nineteenth century meteorology did from the discovery of the law of storms.

Even had he not discovered the isothermal layer—which he subsequently renamed the "stratosphere"—Teisserenc de Bort would rank with the greatest meteorologists. His idea of "centers of action" in the atmosphere is pregnant of practical and theoretical results not yet fully realized. He was one of the foremost advocates of the world wide outlook in meteorology and the founder of the plan of collecting daily meteorological reports by telegraph from stations all over the globe now being elaborated by an international commission, of which he was president. His charts of high level isobars, and his discovery of the relations between anomalies of temperature and pressure, marked definite advances in our knowledge of the atmosphere. He was one of the creators of the international classification of clouds. He joined with Rotch in fitting out the expedition, on the yacht "Otaria," which established the existence of the antitrade winds above the northeast trades.

In company with H. H Hildebrandsson he began some years ago the publication of a great historical work on dynamical meteorology, unhappily not yet completed. In 1908 he received the Symons gold medal of the Royal Meteorological Society, which is awarded every two years "for distinguished work in connection with meteorological science. He was recently elected a member of the Academy of Sciences.

The Growth of Stumps

IT occasionally happens, particularly with trees growing in wet or very moist soils, that stumps of the Cuban pine (*Pinus heterophylla*) and long leaf pine (*Pinus palustris*) continue to grow by laying on very narrow annual rings of woody tissue for a number of years after the trees have been felled The stumps of Douglas fir (*Pseudotsuga taxifolia*) and redwood (*Sequoia gigantea*) likewise continue to grow in diameter for a longer or shorter period of time It was observed some time ago in Florida that a good many stumps of Cuban and long leaf pines felled more than ten years previous had continued to form annually new layers of growth These annual rings are very narrow, often only from three to six cells wide, and are indistinctly visible even under the high power of the microscope

What appears to puzzle the forester most of all is how the roots retain their vitality for such a long time and supply the cambium of the stump and larger roots with a sufficient amount of manufactured food to deposit layers of wood Before the food material can be utilized by the tree it must be manufactured in the leaves. A chestnut tree, for instance, produces new shoots from the root collar as soon as it is felled and the leaves on these young shoots supply the root system with elaborated food. The stump thus continues to live, but the pines do not ordinarily produce stump shoots and can not manufacture food material for themselves. It would seem reasonable to conclude, therefore, that the roots of these pines are parasitic and are grafted on those of the neighboring trees, which supply the pine stumps with the required amount of prepared food The roots of closely allied species of trees often unite, especially in shallow wet soil, where the roots of both young and old trees are near the surface and necessarily come in close contact with one another

The irregularity with which the wood is often deposited clearly indicates that the roots of only one side of the stump have joined those of the living trees. Sometimes the fresh wood deposited on one side is more than double that on the opposite side This new wood produced is often scarcely distinguishable from that formed naturally The fibers or tracheids are usually interlaced and in an isolated state are curved and have blunt ends. The markings on the cell walls are similar to those of normally formed tissue. The compound microscope reveals the fact that the cell walls are slightly thinner and that there is little or no distinction between the early and late wood in these narrow zones.

Holland Gas Exposition

THE gas exposition of Amsterdam, which closed October 13th, 1912, numbered among its exhibitors 200 firms of different countries, only one of which was from the United States. It contained some interesting exhibits, such as the model of a Utrecht factory for making gas from petroleum residue by a process of dry distillation. This invention is considered of especial importance to the United States on account of our large production of petroleum. Other exhibits included a safety gas meter having automatic devices for preventing asphyxiation from escaping gas, an electrical gas lighter having a lighting switch against the wall, and a burner and mantle which can be used with either end up.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Effect of Reservoirs on Freshets

To the Editor of the SCIENTIFIC AMERICAN

Mr H R. Flint's article on the control of the Mississippi, in your January 11th number, contains an important fallacy which should not be passed unchallenged Mr Fl nt pretends that the existence of reservoirs, even those of "many square miles in extent," does not regulate or equalize the flow, for the reason that "the extra water that causes the flood comes on top of reservoirs already filled" by previous rains. In this assumption, however, he is quite mistaken, even if it were not true that the level of reservoirs in all modern constructions can be and is regulated according to requirements. The rate of flow over the spillway of a dam varies with the square of the head, or level of water in the reservoir above the edge of the spillway, and this head will of course, for a given quantity of water flowing into the reservoir, vary inversely as the reservoir's area. This is a fact of such common observation, even aside from any mathematical consideration, that no demonstration should be required Water powers on streams are rendered useful in proportion to the storage capacity of the reservoirs back of them The immense value of Niagara's power consists largely, if not mostly, in the greatest power reservoir in the world which lies back of it.

Of course, the existence of a reservoir must "lower the ultimate high-water mark attained by the stream" by just the amount of water added to the reservoir, and inversely as the time it takes to run out.

This is not in any sense analogous to the influence of a forested watershed on stream flow, as Mr Flint assumes, because when the ground is saturated, the "reservoir" is filled to capacity and no longer stores any water

Milwaukee, Wis. GEORGE W COLLES

The Alaska Reindeer Industry

To the Editor of the SCIENTIFIC AMERICAN

I have just noticed in the issue of January 4th the letter of Mr A. W Williams, of Chena, Alaska, regarding the Alaskan reindeer herds, which, in view of the wide circulation of the SCIENTIFIC AMERICAN, I consider worthy of notice.

Mr Williams implies that the Bureau of Education's reindeer enterprise in Alaska is unsuccessful in that it does not provide a draft animal and a meat producer throughout all of the vast and varied regions of Alaska.

Mr Williams has entirely misconceived the object of the Bureau of Education in this undertaking It is neither the duty nor the endeavor of the Bureau of Education to furnish Alaska generally with a draft animal and a meat producer Its Alaska reindeer industry is confined solely to the native population of Alaska, its object is to provide assured means of support for the natives of the vast untimbered grazing lands of northern and western Alaska, which are adapted for reindeer raising in this it has been eminently successful.

Instead of being "confined entirely to narrow strips of land bordering the oceans," the reindeer industry affects a region approximating in length the distance from Maine to South Carolina. In this region reindeer herds are found in the valleys of the Noatak, Kobuk, Selawik, Yukon, Kuskokwim, and other rivers, at many points hundreds of miles from the coast. The northernmost herd is near Point Barrow, on the shore of the Arctic Ocean, in latitude 71 degrees 27 minutes, longitude 156 degrees 20 minutes, the southernmost herd is at Ugashik, in southwestern Alaska, forty miles from the North Pacific Ocean, in latitude 57 degrees 50 minutes, longitude 154 degrees 50 minutes. A straight line from Point Barrow to Ugash k is approximately 960 miles in length A line connecting each of the fifty-three herds would be more than 5,000 miles in length

The official reports for the fiscal year ended June 30th, 1912, show a total of 38,307 reindeer in Alaska, of which 624 natives own 24,003, or 62 per cent, representing at an average value of $25 a capital of $600,075. The total income of the natives from the reindeer industry during the fiscal year, exclusive of value of meat and hides used by the natives themselves, was $44,885.04.

Mr. Williams's statement that my natives (I was the superintendent to whom he referred) "had to shovel snow several hours in order to enable the reindeer to reach their food," and that the Government had required "the continued services of between thirty and forty men to shovel snow off the moss" or the Holy Cross herd, is without foundation. No men were employed to shovel snow and, so far as I know, none was shoveled. On the trip to which he has referred, I used reindeer as draft animals all winter, covering a trailless country from Unalakleet to Cold Bay, via Kuskokwim, Nushagak, and Iliamna, traveling a distance of more than 2,200 miles—a record to compare favorably with that of the best dog teams in Alaska, when cost, comfort, and condition of trails are taken into consideration I neither broke trails on snow shoes, nor pushed behind handle bars—I rode

W T LOPP,
Washington, D C Chief of Alaska Division

What is Mentality?

To the Editor of the SCIENTIFIC AMERICAN

In recent years I have had more or less to do with feeble-minded people, and have come to a new realization of how much mentality depends on physical organization This experience has materially modified theories previously held as to the genesis of the individual mind

My present theory is this Mentality, thought, consciousness, whatever you will, is the expression of the reactions that occur between nervous (electro-chemical?) energy and energy generated in the blood stream The brain alone is usually spoken of as the organ of mind, but the brain in itself is as powerless to produce mental action as a dynamo to produce electricity without conjunction with some external force This external force in the case of the brain is the energy produced by the blood All brain action ceases at once if the blood supply is shut off, and the individual drops into the blank of extinction

A long array of facts, inexplicable by the brain theory, are reasonably explained on this hypothesis of brain and blood interaction The normal mind arises from normal blood and brain When either of these is abnormal, or both abnormal, the resulting reaction is abnormal and we have the abnormal mind

The animal body is a wonderful chemical laboratory, and the blood it manufactures is composed of many chemical elements contributed by the numerous glands and other tissues Now if any of these glands and tissues are defective or absent, so that the elements they furnish are defective or missing, the blood is thereby made defective and a defective mentality results If a person has a diseased thyroid gland, or if it is missing, we have the cretin, a feeble-minded person If this gland has such decided influence on the quality of mind may it not fairly be assumed that other glands have a similar influence? Indeed, we know they have The gelding has neither the robust mentality nor the robust physical constitution of the entire animal

In all the past and up to the present, mankind has been unable to discover the real nature of insanity, epilepsy, feeble-mindedness, because they have looked for the cause in the brain alone or in the nervous system, or in the secretions alone the secret lies probably in the reactions indicated and these have been and are still beyond detection.

Everything that comes into existence does so through some process In a universe where everything is inexplicable in its ultimate to the human understanding is this hypothesis as to the genesis of the individual mind unreasonable? Henri Bergson says "From this ocean of life in which we are immersed, we are continually drawing something and we feel that our being, or at least the intellect that guides it, has been formed therein by a kind of local concentration" Supposing that there is an ocean of life or an ocean of mind still there must be an individual process to generate the individual life or mind, there must be this "local concentration" as Bergson terms it, and why should not the interaction of blood and brain energy be the process, seeing that both are necessary to life and mind?

Of course individual, conscious immortality is destroyed by this hypothesis, for when the complex of forces is dissolved out of which the individual arises, body and mind, the personality is forever dissolved

Perhaps this theory is not new, but so far as I am concerned it is If a similar one has been advanced by anyone, I have not seen it It it can be shown to be untenable, well and good It is the truth, so far as we are able to comprehend the truth, that we want.

Fairibault, Minn EDGAR ODSON

The Fallacy of the Spring Wheel

To the Editor of the SCIENTIFIC AMERICAN

For purposes of comparison, assume that a vehicle is equipped with full elliptical springs between the body and the axle and that the wheel is a "perfect spring wheel" When a load is imposed upon the vehicle, the elliptical spring and the bottom and top spring of the wheel will be depressed This depression we may call the normal depression. If the wheel is to have the same shock-absorbing efficiency as the elliptical spring, then the normal depression of both must be approximately equal. In the case of the wheel springs, however, it is clear that the springs below the hub of the wheel and the springs above the hub are flexed in opposite directions, so that in one revolution of the wheel the springs in it must undergo a flexure of double the normal depression Therefore, if the vehicle were driven over a perfectly level road, the elliptical spring would simply remain in its position of normal depression while the springs in the wheel would sustain a flexure of double the amount of the normal depression at every revolution The spring of a 40-inch wheel would therefore sustain approximately 525 double normal flexures in every mile in addition to the flexures caused by the absorption of irregularities of the road

The working of the springs due to the irregularities of the road will be the same in either case Now, if we represent the amount of this working per mile by X, the normal depression by Y, and the miles by M, we can represent the comparative working of the two springs as follows

Work in elliptical spring, MX

Work in spring wheel, $M(X + 1{,}050\ Y)$

The springs in the wheel must therefore undergo 1,050 complete normal flexures in each mile more than the elliptical springs. This would develop an amount of heat and a rate of depreciation in the spring wheel which, in the opinion of the writer, makes it practically certain that no spring wheel, however ingenious and perfect in action, will ever become a practical success

This same reason is recognized, even by the layman, as the cause for the rapid depreciation in automobile tires, but so far as the writer is aware, has never been recognized in connection with the spring wheel

Plainfield, N J G F FISHER.

Panama Canal and Free Tolls to Domestic American Shipping

To the Editor of the SCIENTIFIC AMERICAN

The note of Earl Grey to the Government of the United States in protest of the free tolls to American domestic shipping using the canal in trade between United States ports, made the point that if American shipping did not pay tolls, there would be no means of ascertaining the additional burden that would be laid on foreign tonnage

That would hardly seem to enter into the case, at least not for many years, as Prof Emery Johnson pointed out in his report to the United States Government that the United States would have to make up the deficiency in the canal revenue for years to come, even though American ships all paid tolls

So as far as foreign tonnage is concerned, the United States allows foreign tonnage to use the canal at less than cost

Free tolls for American domestic shipping is indefensible from every and any standpoint It is in effect a subsidy to as great a monopoly as exists on the sea—American coastwise tonnage

American coastwise tonnage is shielded from the competition of any foreign steamers None but American-built craft can engage in the trade between the United States Atlantic-Pacific ports

To give this tonnage free tolls is the same as handing it money from the United States treasury, and no thought whatever is given to the interests of shippers No thought apparently is given as to the possible combination that may be effected by the owners of American coastwise tonnage that will engage in the trade

And from the present reports of the activity in shipyards the world over, including the United States it would not be a surprising thing to find that in the course of a year or two, it would be a difficult matter to place an order for tonnage and secure anything like prompt delivery, freights meanwhile being at the mercy of tonnage owners that have no more hesitation in charging all the traffic will bear than have railroads

And besides this, there is a phase of the matter that so far has apparently not been touched American steamers engaged in trade to foreign ports and using the Panama canal will have to pay tolls While American steamers engaged in domestic coastwise trade using the canal will go through free

On what grounds can Congress make such a distinction? It is class legislation pure and simple, discrimination of the worst sort, taxing American steamers engaged in foreign trade and exempting them in domestic

No one has ever claimed that we would have to extend aid to tonnage to uphuild our coastwise trade The efforts that have been made in Congress in the last decade have been in behalf of American tonnage that was to upbuild our deep-sea foreign trade American tonnage on the deep seas "could not stand the competition of foreign steamers" "It cost more to operate the American, cost more to build and compete it was necessary that Congress extend aid in the shape of bounty or subsidy," and Congress turned a deaf ear to that part of the American merchant marine that did make a somewhat plausible showing, that needed aid, and later grants a measure of subsidy—for that is what free tolls is in effect—to that part of the American merchant marine that not alone needs no subsidy of any kind but which is and has been favored as has the shipping of no other nation

In the interest of American fair play the free toll measure should be recalled, that would be one justifiable act And not alone in the cause of justice should it be, but on the ground of discrimination there is nothing in the Constitution or in law that permits Congress to levy tolls on American shipping using the canal and destined for ports outside of the United States, and giving free passage to American ships destined to ports of the United States.

CHARLES DEPESER.

Chicago, Ill.

Hauling twenty-two and one half yards of crushed rock in five dump wagons.

Economics of the Farm Tractor

The New Way of Tilling the Soil and What it Means

By Philip S Rose

SINCE the very dawn of time agriculture has depended upon the muscular power of men and animals to perform all of its heavy work Even after all of the other great industries had adopted steam or gas or electricity, agriculture continued to plod along in the time honored custom, because forsooth nothing else was available This condition continued until very recent times. About a dozen years ago the steam tractor was developed sufficiently to attract the attention of many of the large western grain farmers and then, less than ten years ago the gas tractor using gasoline or low grade kerosene for fuel, made its first appearance From that time forward the pace has been rapid.

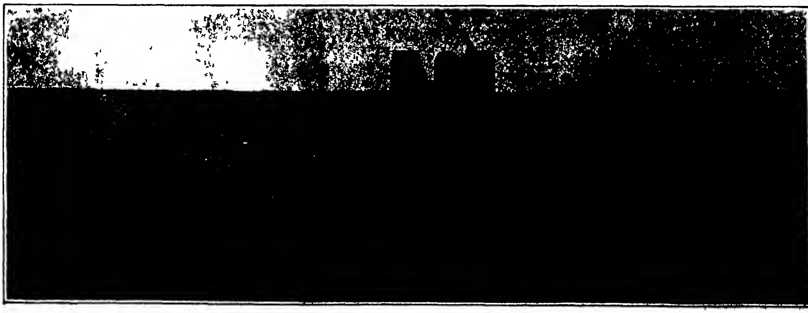
Farmers everywhere are now talking about power farming and thousands have become converts to the new idea Six years ago there were not to exceed five hundred gas tractors in the United States Last year more than thirteen thousand were sold, and this year the factories of the United States will turn out no fewer than twenty thousand Five thousand of these will be sold in western Canada Of the remaining fifteen thousand some will go to South America, some to Russia and some to the various countries of Europe but the greater number will be sold to the farmers of the United States

Next year more than twenty thousand will be made and sold The demand is greater than the supply and continues to increase from year to year There are now more than eighty companies engaged in their manufacture, and new ones are being formed almost weekly Such is the condition of the business, and its prospects for the future seem very bright indeed It looks as though the commercial success of the automobile were to be repeated in the farm power field

All this activity is easy to understand when one comes to consider the immense expenditure for power necessary to conduct the agricultural operations of the country The total cultivated area of the United States is 477,488,000 acres, of which a little more than 43,000,000 is annually devoted to the hay crop, thus leaving about 435,000,000 acres that must be plowed and made ready for the crop each year It is estimated that the average work necessary to plow an acre is about ten horse-power hours. At the Winnipeg Motor Contest last year the average of all trials showed that it required 15.41 horse-power hours to plow an acre, so the figure selected appears to be on the safe side. Using this as our power factor, we find that the total expenditure of power for plowing the ground once each year is 4,350,000,000 horse-power hours. In order to accomplish this task and do the other necessary work, which amounts to more than twice as much additional, there were on January 1st of the past year, according to the report of the Secretary of Agriculture, 24,002,882 horses and mules on the farms of the United States. Their total value, as given by the same source, was estimated at $2,698,351,000. The average value per head is thus $112.53, which is certainly low enough These animals are maintained almost exclusively for farm power use, and do not include those used in cities and villages. If we take into account the harnesses and other gear required before this power is available, estimated at fifteen dollars per animal, it is evident that the farmers have the prodigious sum of three billion dollars invested in power equipment.

If we assume in round numbers 480,000,000 acres as the total cultivated area, and three billion dollars as the investment, a

Billows of earth left in the wake of a tractor plow.



Majestically a huge tractor moves through acre after acre, drawing in its train a dozen agricultural implements.

little calculation will show that the farmers of this country have an average of $6.25 an acre invested in animal power. This sum seems excessive, but as a matter of fact it is greatly exceeded by many farmers. The truth of the figures becomes apparent when one considers that they provide only two work animals to each forty acres of cultivated land. Besides, the estimated value per animal is very low. There are hundreds of farms where the cost per acre is greatly in excess of the figure given.

Authorities differ as to the annual cost of keeping a horse. Grisdale, of the Ottawa Experimental Farms, reports an annual cost of $99.80 for each of the nineteen horses at the station farm. Burkett, of the New Hampshire Station, reports the average cost of keeping five horses at $74.38 each, while Cooper in Minnesota found the farm cost of keeping horses to vary from a minimum of $65.23 to $90.40. If we assume an average cost for the entire country of $75 per head, which seems reasonable in view of the above figures, we find the total cost of maintenance of this important industry reaches the enormous sum of $1,805,400,150 or $3.76 per acre.

The total value of all agricultural products for the year 1911, as estimated by the census, is $8,417,000,000, which amounts to $17.53 per acre for the entire United States. From this it will be seen that it requires 21.4 per cent of the products of the farms to maintain their work animals. In other words, more than one hundred million acres are required to raise food and pay for the maintenance of the horses and mules of the United States. Truly this is an enormous tax upon our national resources and at a time, too, when the production of human food is not keeping pace with our increasing population. Is it any wonder that farmers are looking toward mechanical power with eager hopefulness? These animals do not furnish food or clothing directly and hence their total cost must be chargeable to the annual national farm power bill. In this discussion, it should be especially noted that we have omitted all interest and depreciation charges. If these were taken into account we should have to add about sixty two cents more to the maintenance charge per acre, which would bring the total up to $4.38, or almost exactly twenty five per cent of the country's agricultural production annually.

While perhaps few farmers have ever kept an accurate account of the cost of keeping their work animals, they are nevertheless, aware that they are paying an enormous price for the power needed to do their work. Not only are they paying a heavy price for the power itself, but the fact that it is divided up into such small units makes it necessary to employ many extra laborers during the busy season. The change to mechanical power operates in agriculture just as the adoption of improved machinery in manufacturing. It reduces the number of men required to perform a certain piece of work, and thus reduces the cost.

Owing to the nature of farm work and the fact that there is a long idle period during the year, it is difficult to maintain enough laborers in the country to do the work during the busy season. This fact, coupled with the high maintenance cost of work animals, has turned the minds of farmers toward mechanical power. They figure that they can well afford to buy a tractor instead of keeping a dozen or more horses. The tractor does not require special attention during the times it is idle. It does not cost anything for fuel while idle. It does not require as many operators as the horses it replaces, and it is able to turn out more work in a day. Moreover, it is able to work longer hours and during the hottest weather. The speed with which it can prepare a field for a crop or seed the ground after it is prepared is an important item, for it is well known that the yield often depends upon the soil condition when the ground was plowed or the moisture content of the soil when the seed was planted. A rapid machine like a tractor enables the farmer to take advantage of soil and climatic conditions much more successfully than when he depends upon horses.

It is true that the tractor is not adapted to the small farmer. It costs too much. Prices now range from $1,200 to $3,000. The higher price is for the larger machines which will develop anywhere from fifty to eighty horse-power.

These machines can easily do as much as twenty-five or thirty horses, while the smaller machines, which will develop from fifteen to forty horse-power, are fully equal to ten or a dozen horses. The first cost of the larger machines is not much if any greater than of the horses which they replace while the cost of the smaller machines is not greatly in excess.

It is the general opinion of well informed tractor men that it will pay any farmer who has two hundred or more acres under cultivation if his land lies right, to purchase a gas tractor. For a farm of that size he will need one of the smaller machines. His power bill for the year should then figure about as follows:

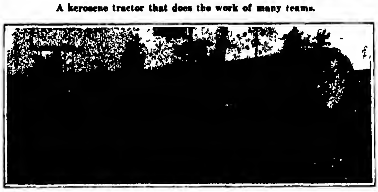
Interest at 6 per cent	$72
Depreciation	200
Fuel, oil and labor	160
Total	$532

At the average of $4.38 for all horse labor the total would have amounted to $876. These figures show a gain of $344 for the tractor.

Any set of estimates are liable to be misleading. Much depends upon the character of the farm where mechanical power is contemplated as to whether it will pay to make the change or not. The kind of farming and the mechanical ability of the farm owner or manager are the items that must come in for careful consideration. Perhaps the best way to approach the subject, and thus arrive at the fact, is to consider the experiences of those who have used gas tractors.

Pulling binders by engine power

A kerosene tractor that does the work of many teams.



Hauling logs in Tennessee over roads that are roads only in name

There is no place in this country where power farming is carried on more extensively than around Beach, N. D. and Wibaux, Montana. The farms are large and horses are used merely for driving purposes and to haul light loads from town if the farmer does not possess an automobile. All the heavy work such as plowing, disking, seeding, threshing and hauling the crop to market is done with tractors. Many steam tractors are used, but gas tractors are the favorite.

As an example of the amount of work a tractor can do in a season, take the record of E. G. Paul, one of the Beach tractor farmers. Last year he plowed 810 acres of sod, disked 800 acres, seeded 1,600 acres, harvested 1,440 acres and threshed and then hauled his grain to market besides doing a considerable amount of road grading. E. A. Beasley, a prominent farmer near Lake City, Iowa, says he finds his tractor more economical and satisfactory than horses. Joe Edgington, another Iowa farmer, reports that it cost him less than eighteen cents an acre to do his plowing last fall with an engine burning distillate. He used two and three quarter gallons an acre, which cost him six cents a gallon.

The most of Montana has been developed with mechanical power, and the three western provinces of Canada depend upon it. It would seem if these Canadian farmers can make power farming pay that the farmers of the United States would certainly find it profitable. In order to obtain some idea of the costs of operation and to obtain an expression of opinion regarding the efficiency of the tractor I sent out a list of questions to forty four Canadian farmers, asking the cost of fuel, cost of outfit, labor charges, repairs, etc. and finally asking for an expression of opinion in regard to the future of the gas tractor. Eleven replies were received and every one expressed the opinion that the gas tractor would soon displace every other kind of power in Canada. This, too, in face of the fact that tractors cost twenty five per cent more than in the United States, and fuel fully twice as much. Several reported using gasoline that cost twenty-seven cents per gallon and yet they were enthusiastic for the gas tractor.

The work reported as being done by tractors covers a wide range and includes all field operations, such as plowing, seeding, harvesting, hauling to market, threshing, corn shredding, grinding, baling hay, filling ditches, and road grading.

There is no question but we have entered upon a new era in agriculture. The farmer desires the comforts and advantages of the city dweller and these he gets easily and cheaply with the small gasoline engine. He sees that the gas tractor is suitable for the heavier field operations and is generally more economical than horses, and he is not slow to make the change. It enables him to accomplish more in a season. It multiplies his capacity and gives him either more leisure or enables him to farm a larger area and increases his income.

Power farming has just begun, and the start is encouraging. Whether it will accomplish the revolution in agriculture that it has in manufacturing and transportation only time can decide, but it seems safe to predict that it will bring about many interesting social and economic changes.

X-ray Pictures of Micro-organisms

By Dr. Alfred Gradenwitz

THE latest advance in the field of radiography is the use of X rays for examining microscopic preparations.

If in spite of the many sided applications of X rays, no attempt had so far been made to use them for microscopic study, this was doubtless due to the serious experimental difficulties to be overcome. A French scientist, M. Pierre Goby, at Grasse, has however, by means of a special apparatus (particulars of which will only be made known in a short time) succeeded in removing these difficulties and investigating opaque microscopic preparations by radioscopy in all their most hidden details.

As pointed out in a memoir recently submitted to the French Association for the Advancement of Science, Goby at first placed his micro-radiographic work in the services of paleontology and conchyliology. The most primitive organisms (protozoa) all kinds of foraminifera and similar microscopic beings can thus be investigated in their innermost structure. Goby has even succeeded in ascertaining the existence of differences in species when ordinary methods of investigation only showed the existence of a single species.

It is known that sea sand contains fossil remains of all sorts of microscopic organisms. When examining a sample of such sand under the microscopic X ray apparatus, a surprising abundance and variety of forms is revealed, each individual being analyzed far more safely than under the microscope. In addition to these applications, micro radiography also lends itself for investigating the formation of the bones of small vertebrates from their birth to the adult stage. Apart from the structure of bones, peculiarities of the skin and any anomalies of small, though not microscopically small animals can be investigated with the utmost care, any fleshy parts and even muscles becoming transparent so as to come out distinctly on the background. Studies in comparative anatomy are thus greatly facilitated.

Other applications will doubtless be found in the near future, those above mentioned would seem to give an adequate idea of the possibilities of this new science, the further development of which will be left to the experimenters themselves.

The Library of the Late Prof. Skeat has been presented to King's College, London, where, with the library of the late Prof. Furnivall, presented to the same college, it is to form a departmental library of the School of English Language and Literature.

The Heavens in February

How Astronomical Predictions Have Been Verified in the Laboratory

By Henry Norris Russell, Ph D.

PROBABLY the most remarkable feat of astronomical spectroscopy has been its discovery (by its spectral lines in the light of the solar atmosphere) of the rare gas helium long before this element had been run to earth in our laboratories. A similar story hardly less remarkable has just come to its final chapter by the production in the laboratory of a set of lines in the hydrogen spectrum, long ago known to exist in the stars

In some ways this tale is even more remarkable than that of helium It is easy enough to understand that when astronomers find in the spectrum of the Sun's chromosphere a number of lines that cannot be reproduced from any known substance, under any known method of treatment they may legitimately assume these lines to be due to some unknown gas, and call it helium from the place of its presumed occurrence

But in the case now under discussion a number of spectral lines never observed (till many years later) in the laboratory have been confidently assigned to hydrogen one of the most familiar of substances, and, what is more the positions of other lines of hydrogen never observed in the stars, and incapable of observation there, have been predicted and after fifteen years these assumptions and predictions have been triumphantly verified by experiment

To understand how these truly extraordinary things have been done, we must consider for a little the fascinating subject of series of lines in spectra

In the spectra of many elements, there exist sets of lines, sometimes single often double or triple which show a regular spacing, the successive pairs lying nearer to one another and becoming fainter toward the violet end of the spectrum When the number of lines in the spectrum is great it is often difficult to pick out such series if they exist but in spectra showing relatively few lines, the series are often the most conspicuous features.

Perhaps the finest of all examples of such a series is the great system of hydrogen lines which are so conspicuous in the spectra of the white stars (like Sirius) and appear also with less intensity in the solar spectrum The same lines may be produced without difficulty, by passing an electric discharge through hydrogen contained at low pressure in a vacuum tube As long ago as 1885 Balmer showed that the wave-lengths of these lines (which define their position in the spectrum) could be calculated with great exactness by the formula

$$\lambda = 3646.13\,\frac{m^2}{m^2-4}$$

in which $m = 3$ gives the wave-length of the red line (called C in the solar spectrum) $m = 4$, that of the blue F line, etc. The remaining lines lie in the violet and ultra violet parts of the spectrum, and lie closer and closer together crowding toward a definite limit. Only about eight of them can be photographed in the spectrum of the vacuum tube, but in the stars and the solar chromosphere, where conditions seem to be in some way more favorable many more can be seen. In fact, all the lines of the series as far as $m = 31$ have been measured on Evershed's eclipse photographs, and the agreement of the observed and calculated wave-lengths is practically perfect.

Study of other elements showed the existence of similar but somewhat more complicated series. The alkali metals—sodium potassium, etc—show in their spectra *three* series of pairs of lines. The numerical formulae for calculating their positions become simpler if we take not the *lengths* of the light waves, but the *number* of waves in a given distance say a centimeter When this is done it is found that the interval between the lines of a pair measured in this way is exactly the same for all the pairs belonging to two of the three series while the third series is composed of pairs which grow rapidly closer as the lines lie farther to the violet

The first two series of lines have the same limit, toward which the successive pairs converge, while the limit of the third series is usually far in the ultra violet This last series contains the strongest lines in the whole spectrum and is consequently called the "principal series" The other two "subordinate series" of fainter lines may be distinguished from one another by the fact that the lines of one series are usually sharp, and those of the other usually diffuse when examined under high dispersion. These sharp and diffuse series are so arranged that the pairs of one sort and the other alternate in the spectrum, presenting a very beautiful picture, which can be seen by any one who can look, with a spectroscope of very moderate power at an electric-arc whose carbons are plentifully treated with some salt of sodium.

It will not do, however, to use a Bunsen burner, for, at the relatively low temperature of its flame, only the lines of the principal series of sodium are visible, and but one pair of these—the familiar lines in the yellow—lie within the visible spectrum It is not until the atoms of the metallic vapor are exposed to the more violent disturbances, thermal and electrical, which befall them in the electric arc that they begin to vibrate in the ways, and at the rates, which give rise to the lines of the subordinate series.

Very interesting numerical expressions for the wave-lengths of the lines of such series have been given by Rydberg, who uses equations of the form

$$\frac{1}{\lambda} = n_0 - \frac{N}{(m+\mu)^2}$$

in which m has the values 2, 3, 4, etc., n_0 and μ are constants, different for each series of lines, and N is a "fundamental constant," which is the same for all series and all elements, and must depend on some universal peculiarity of atomic structure.

The constant μ is usually not a whole number, but is less than unity If we make it exactly unity, and give n a proper value, the formula reduces to that for the "balance series" of hydrogen.

When the equations for the different series are written in this way a remarkable connection appears between the "principal" and "sharp" series. In fact, the equations for the two may be combined in the formula

$$\frac{1}{\lambda} = \frac{N}{(m_1+\mu_1)^2} - \frac{N}{(m_2+\mu_2)^2}$$

(considering for simplicity a series of single lines)

Here μ_1 and μ_2 are two constants. If we keep $m_1 = 1$, and give m_2 the values 1, 2, 3, 4, we get the positions of the lines of the principal series, while if we let $m_2 = 1$, and make $m_1 = 2, 3, 4$, etc., we get (after changing signs) the wave-lengths of the sharp series. It is obvious that if we know the lines of one of these series we can work out the formula, and then calculate where the lines of the other series ought to be.

This relation has been tested on several elements showing such series in their spectra, and found to be generally true (though not perfectly accurate, presumably because the exact formula is a more complicated algebraic expression)

The bearing of all this on hydrogen and astronomy is as follows In 1896 Pickering discovered, on photographs of the spectrum of Zeta Puppis (now visible low in the southern sky) a series of lines in the middle of the intervals between the familiar hydrogen lines, and very like them. On measuring their wave-lengths, he found that they could be very closely represented if, in the well-known formula of Balmer, the values $m = 3\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{1}{2}$, etc., were inserted instead of 3, 4, 5, etc. This was evidence enough to make it very probable that the new lines were really due to hydrogen, whose atoms were stirred up to vibrate (perhaps by very high temperature) in additional ways, besides those already familiar, just as happens to the sodium atoms in passing from the flame to the arc.

Rydberg, after Pickering's measures were published, promptly showed that the positions of the lines could be very accurately represented by a formula of his type The two series of hydrogen lines appeared to be related just like the two "subordinate series" in the spectrum of sodium, etc., the familiar lines corresponding to the "diffuse" and the new to the "sharp" series. It was now possible, using the last formula which is written down above, to predict where the lines of the principal series of hydrogen ought to be, if the previous hypotheses were true.

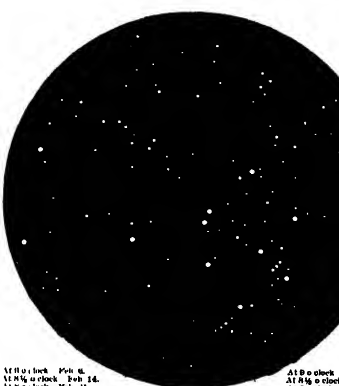
One of these predicted lines of wave-length 4686 on the usual scale, in the blue, agreed with the uncertainty of the measures with a bright line observed in the spectrum of Zeta Puppis and some other stars, and also in the spectra of some nebulae, and (as was later shown) faintly in the Sun's chromosphere The other predicted lines lay in the extreme ultra violet, with wave-lengths less than half that of the D lines. For light of such short wave-lengths, our atmosphere is very imperfectly transparent. Thicknesses of a few feet, such as come into question in laboratory measurements, exert a moderate absorption, but the miles of air through which the light of the Sun and stars must come are, for these rays, entirely opaque

There was hence no further possibility of testing Rydberg's brilliant hypotheses by astronomical means.

So the matter stood for fifteen years, until Prof Fowler of South Kensington, a very distinguished spectroscopic authority, discovered, only a few months ago, that if a very powerful electric discharge is passed through a mixture of hydrogen and helium, in a vacuum tube, the lines under discussion can be observed. Hydrogen alone has not yet been made to give the new spectra, but from the reasons already given there is no doubt at all that it, and not the associated helium, is responsible for them.

The measured positions of the lines of longer wave-length agree perfectly with those observed in the stars, and the lines of the principal series are there, in just the calculated positions. An additional set of lines, intermediate between those of the principal series, and forming a fourth series, related to it very much as the other two series are related, have also been shown on Prof. Fowler's plates, but all these lines are so far in the ultra violet that they are of no astronomical importance.

It would hardly be possible to find a more beautiful instance of the confirmation of scientific predictions; and all concerned in it—Prof. Pickering, Prof. Rydberg, and Prof. Fowler—may well receive the heartiest congratulations upon the completion of this almost romantic chapter of spectroscopic history.



At 11 o'clock Feb. 6.
At 10½ o'clock Feb. 14.
At 10 o'clock Feb. 21.

At 9½ o'clock March 1

At 9 o'clock Mar. 8.
At 8½ o'clock Mar. 16.
At 8 o'clock Mar. 23.

NIGHT SKY: FEBRUARY AND MARCH.

The Heavens.

The winter constellations are so familiar that we need not linger long over our map. We need only find Orion in the southwest, Cassiopeia in the northwest, Ursa Major in the northeast, or Leo in the southeast, all groups which, when once learned, cannot be mistaken for anything else; and then to fill in between them with the map as our guide. It is worth note, however, that the star Zeta Puppis (Argo Navis), which shows the series of hydrogen lines of which we spoke

(Continued on page 131)

The Fourth Award of the Scientific American Medal

An Oxygen Fed and Driven Device for Artificial Respiration

THE fourth bestowal of the SCIENTIFIC AMERICAN Medal was made with the usual care by the Jury of Awards of the American Museum of Safety on January 23rd at a largely attended meeting held in the auditorium of the United Engineering Society's building. Before the meeting, at which four medals were awarded, a dinner was served in the Rossiter W. Raymond room, which was attended by ninety distinguished guests, including Dr. and Mrs. Andrew Carnegie, Mrs. Thomas A. Edison, and many other persons well known in humanitarian movements.

President Arthur Williams presided at the meeting. The SCIENTIFIC AMERICAN Medal was awarded to the Draeger Oxygen Apparatus Company of Pittsburgh, Pa., and Lübeck, Germany. The presentation address was made by Dr. Frederick H. Hutton.

In part Prof. Hutton said:

"It is the pleasant and precious privilege of the Museum of Safety to be the representative of the community and of you all in recognizing the splendid quality of altruistic service. It is the dream and inspiration of the Museum, that on some day the trustees may discharge this duty in its own building built and operated by the State, which has delegated its duties to it, and by the municipality which benefits principally by its activities, as well as by the generous co-operation of the individuals who recognize its opportunities. But, at present, we do this pleasant duty in a hall belonging to someone else, and the medals which we award are the gifts of individuals or corporations who have been keen-sighted to see that by endowing such a medal they were fostering and fanning the spirit of uncompensated service for industrial mankind.

"These medals are four in number. They will first be listed and the recipient named, with the reasons for the action taken, and then the delegated representatives will be asked to come to the platform, that the medals may be handed to them in person.

"The medals are listed in chronological order.

"The SCIENTIFIC AMERICAN Gold Medal must be for some safety or life-saving device, invented within a recency of three years, and exhibited in the Museum's collections. The device selected for 1912 in this class is the Pulmotor.

"The phenomena of respiration are combinations of mechanical action and chemical re-actions. The presence of poisons in the blood-current stimulates the brain cells, which automatically start up the muscles of diaphragm and thorax, whereby the chest cavity is expanded and air flows in to react upon the blood exposed to such oxygenating action. If the poison is excessive, if the lung cavity is filled with water, or if the chemical compound in the blood is stable or unbreakable, oxygenation does not take place, the nerve centers are paralyzed and death results. If the nerve centers are paralyzed by excessive electrical action, respiration stops."

We give herewith a description of the Pulmotor in greater detail than was possible in an address.

The Pulmotor, for which the specific award of the SCIENTIFIC AMERICAN Medal was made, is an oxygen-feed device designed primarily to induce respiration by artificial means in persons overcome by noxious gases, electric shock, the apparently drowned, or in any other cases where the breathing of the patient has been seriously impaired or stopped entirely, but where there still remains a slight heart action. The object of the apparatus is to inflate and deflate the lungs in a rhythmic manner, and the pulsations of the mechanism are so timed that about the normal number of respirations per minute is obtained. Its motive power is an oxygen cylinder containing this gas under a pressure of 120 atmospheres, which will supply a 60 per cent mixture of air and oxygen to the patient for forty minutes. Should it then become necessary, the empty cylinder may be replaced with a new one with a loss of but a few seconds. It has the great advantage over artificial respiration by hand in that it forces larger amounts of oxygenated air into the lungs than is possible by the ordinary methods of artificial respiration and it makes it possible, through its automatic mechanical action, to keep up the work for long periods. The Pulmotor is so adjusted that it will force air into the lungs until it reaches a pressure of about 3/10 pounds, so that the same result is thus mechanically obtained as forced breathing in a healthy conscious man; therefore when the three pounds pressure is reached the apparatus reverses mechanically until it obtains a negative pressure of three pounds, so that all of the deoxidized air is thrown out, leaving the lungs empty and free for a new supply. This pressure is particularly valuable in cases of gas poisoning because five atmospheres pressure will maintain oxygen in the blood fluid even after the blood cells have been so damaged by carbon monoxide that they are no longer able to maintain life, but life is maintained by this artificial means until the hemoglobin of the red blood cells which normally carries the oxygen can recover itself.

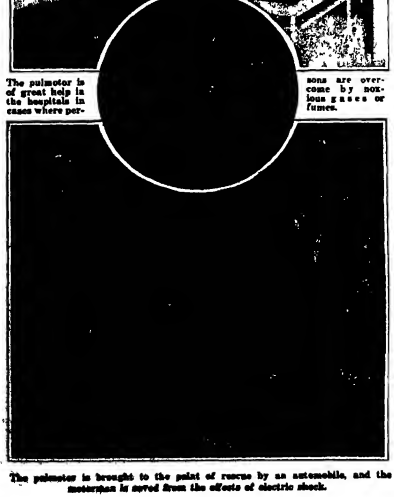
The Pulmotor in its case weighs about fifty pounds, so that it can be carried about readily in automobiles, fire trucks or ambulances. The wooden case contains two entire separate pieces of apparatus, an oxygen inhalation apparatus for ordinary oxygen inhalation (mounted on the lid of the case for use after life has been restored) and the special apparatus for artificial respiration which is housed in the case itself. The two pieces of apparatus have in common the oxygen cylinder and the pressure-reducing valve, and either of them can be set in operation singly by turning a suitably arranged lever to the right or left upon the reducing valve. The steel oxygen cylinder is closed by a valve which can be opened by a turn of the thumb and finger. The cylinder contains 11½ cubic feet of pure oxygen. The oxygen passes from the reducing valve to an injector which has the property of drawing in a large volume of air with a certain force of suction, and propelling that air forward with equal force through the flexible tube in front of the injector. This suction and delivery injector, therefore, serves as a motor, alternately filling the lungs by pressure and emptying them by suction. The most striking part of the Pulmotor is a small leather accordion bellows which effects the automatic reversal of the apparatus from suction to delivery and vice versa when essential. The bellows is connected with the air tubes. During inflation the same pressure obtains in the bellows as in the lungs, and as soon as the latter are filled the bellows becomes inflated and in moving forward causes the valve to be automatically reversed into position for suction. The operation is now reversed, and as soon as the lungs have been emptied the bellows contracts and automatically reverses the valve again into position for inflating—and so on. From what has been stated it will be clear that the respiratory rhythm of the apparatus readily adapts itself automatically to the capacity of the lungs in every case. The rhythm will be slow when the lungs are capacious, and faster with those of smaller dimensions. The apparatus performs all these functions without any assistance from the hands, so that the operator can turn his attention to an important thing, namely, keeping the wind-pipe open and closing the gullet. The essential condition to the success of artificial respiration is the provision of two flexible breathing tubes on the mask. One of these tubes serves exclusively for the supply of pure air and oxygen, while the simple inhalation apparatus can be called into play, and as already stated, this portion of the apparatus is carried on the lid.

Some of the results obtained by the use of the Pulmotor are most remarkable. On February 15th, 1912, several Pulmotors were ordered for installation at as many Byllesby properties. Up to January 1st, 1913, twenty-four lives had been saved by the twenty-three machines, and a number of cases have been reported subse-

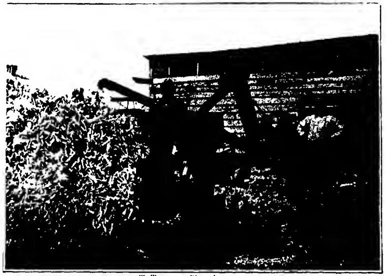
(Concluded on page 131.)

The pulmotor in its case ready for use.

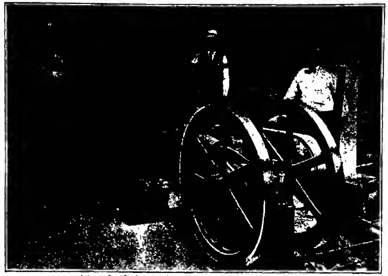
The pulmotor is of great help in the hospitals in cases where persons are overcome by noxious gases or fumes.



The pulmotor is brought to the point of rescue by an automobile, and the motorman is saved from the effects of electric shock.



Shelling corn with engine power

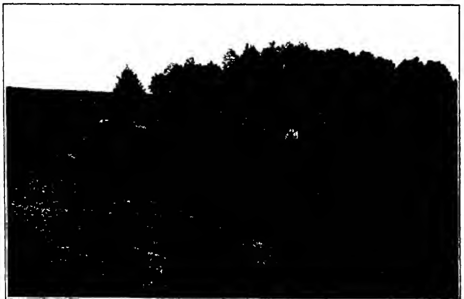


A type of outfit that is reclaiming thousands of acres of desert land

1 A corn fodder canning factory in operation Machinery indispensable on the stock farm 2 A little pumping engine fitted to run a grindstone 3 There are literally thousands of these small home-made tractors in use 4 A gasoline engine is mounted upon this grain binder 5 Cutting up a year's wood in a single day

A pumping engine that can be used for many purposes. Gasoline engines can be bought at the rate of twenty five to thirty five dollars per horse power

Grinding corn by machine on an Iowa farm Every farm can use an engine The small farm of only an acre or two needs at least one, the large farm can use several



Threshing with a ten horse-power two-cycle stationary engine.

The business end of a tractor.

Baling the hay crop by machine.

A GROUP OF INTERESTING MACHINES AND ENGINES WHICH SHOWS HOW GASOLINE AND OIL POWER CAN BE MADE TO DO THE FARMER'S WORK.—[For article see next page.]

Gasoline and Oil Power on the Farm

How Engines Have Lightened Farm Work

By Philip S. Rose

THE uses for the gas engine are legion. It is the mechanical chore boy of the farm, the Percy or mechanical man of agriculture. It can be and is used in the house, in the barn, in the field and in the garden. There is hardly any place where there is work for a man to do that the gasoline engine cannot be used to advantage. It can be used in the house to run the washing machine and wringer, to pump water and furnish lights.

Many farmers have a small shop fitted up near the house where they have installed a shop for the repairing of tools, a laundry, an electric lighting plant, a cream separator, and perhaps a churn and other small machinery, all of which is run by a four or five horse-power engine.

An electric generator of two kilowatts capacity, with a storage battery, will light the house, the barn and the grounds, besides furnishing enough current to operate fans, flat irons, a sewing machine and perhaps a mechanical milker.

The cost of current so generated will not exceed ten cents a kilowatt hour, a figure that compares favorably with what the city dweller has to pay to the central station. If the shop can be built around the well, as many of them are, the same engine can also pump the water and deliver it to all parts of the farm buildings. One of these little machines makes it possible for every farm to have all the modern conveniences of the city home and at no greater expense.

Even if the same engine cannot be used to do all this work it costs very little to buy enough small units to take care of the various jobs that need to be provided for. The cost of a gasoline engine ranges from twenty five to thirty five dollars a horse-power whether the engine be large or small, so there is no economy in buying one large engine. It is better to buy several and place them where they will be needed most of the time.

Doing Farm Work with Gasoline

Such engines will run on about a pint of gasoline per horse-power per hour, or with gasoline at sixteen cents a gallon, at a cost for fuel of only two cents a horse power hour. The same amount of work with human labor will cost at least one dollar and twenty cents, for a man will charge at least fifteen cents an hour and can do only one eighth of a horse-power of work. Furthermore, you know when you set an engine at work that it will not loaf on the job and you are getting the full worth of your money.

If the gasoline engine had been invented and brought to its present state of perfection a hundred and fifty years ago we would never have had human slavery in the South. No slave, no matter how hard the task master, was ever able to compete with one of these mechanical men in the amount of work turned out in a day, nor in the cheapness with which such work can be accomplished.

Our teachers of agriculture tell us that if we are to maintain the fertility of our soils and make a permanent success of agriculture we must raise more live stock. To do this we must grind feed, shred corn fodder and put up ensilage. Cattle and hogs and sheep cannot be allowed to pasture on high priced land, they must be kept in the stables and fed. Here then is where the engine of a little larger size can and must be used. Engines of twelve to fifteen horse-power, either stationary or mounted on trucks so that they can be moved easily from place to place, are the ideal size for this heavy work. In addition they can be used to thresh the grain, and many farmers are so using them. There are a number of small separators on the market designed for just this purpose.

The Cost of Filling a Silo with Power

As an example of how efficient a gasoline engine is for filling silos all we need to do is to turn to a bulletin published by the Virginia Experiment Station which gives the report of experiments on the cost of filling silos with different kinds of power. It was shown in these experiments that the cost of filling a silo with gasoline engine power, using gasoline that costs thirteen cents a gallon, amounted to only two to three cents a ton as against two to seven cents a ton for steam engines using coal at five dollars a ton.

Another big field for the gasoline, or to be more exact in the use of terms, for the crude oil engine is in irrigation. Vast areas in Colorado, Texas and Kansas have been reclaimed with the use of such engines which pump from wells sixty, seventy and even eighty feet deep. Thousands of engines of from five to fifty or more horse-power are already in use and the number is daily increasing.

A gentleman who made a thorough study of conditions in the Louisiana rice fields last summer stated that in one parish in Louisiana alone there is an opportunity to replace fifteen hundred steam engines with an equal number of gasoline engines on account of the high price of coal and the difference in efficiency in favor of the gas engine.

Another large field of usefulness for the gas engine, though not directly concerned with agriculture, is in the *cotton gins of the South*. These are rapidly changing to the cheaper power.

In the fruit growing regions every fruit grower needs a gasoline spraying outfit and it requires one such outfit for every ten acres of orchard, because the time when spraying must be done is very limited and a day or two's delay means the saving or losing of a crop worth thousands of dollars.

Even the poultry farmer finds the gasoline engine indispensable for grinding bone and preparing food for his poultry, while market gardeners all through the humid belt circumvent the vagaries of the weather and overcome the handicap of a long drought by the use of some overhead system of irrigation. One manufacturer, who covers the territory east of the Mississippi River has sold thousands of outfits that irrigate tracts up to ten acres or more in extent and prove sources of increased revenue to those forehanded enough to make use of them.

How Many Engines Are Necessary?

Thus it will be seen that every farm, no matter what the product thereof, can find profitable use for gas engine power. The small farm of only an acre or two needs at least one, while the large farms need several. One farmer writes that he has seven gasoline engines and finds them indispensable, while another reports five. A man engaged in mixed farming in Minnesota declares that every farmer on a quarter or a half section farm ought to have at least three engines of two, six and twelve horse power, respectively. This man started out a few years ago with horses and men as his only source of power, and now has adopted gasoline engines everywhere he possibly can. He still uses horses, it is true, but with the small engines about the farm and a tractor in the field he finds it easy and more profitable to dispense with a large number of surplus horses and keep fewer hired men.

As an example of the value of one of these engines for special service, consider the special binder engine, which, mounted on the rear of a binder, operates the sickle and binder head and thus dispenses with two horses. Where the grain is heavy or the ground muddy it requires at least four horses on a grain binder, but with an engine to operate the working parts of the machine, two horses are sufficient. This was discovered a number of years ago in the Red River Valley when a heavy rain came on just when the grain was ready to harvest. The straw was very heavy and the soil so saturated with moisture that the wheels would fill up with mud and refuse to turn. A number of people then resorted to a gasoline engine fitted up on the rear of the binder, and in that way all that was saved that year of the wheat crop of the valley was saved by the aid of gasoline. Since then there has been a growing demand every year for binder engines. Wherever the grain is very heavy the little engine will relieve one team and do the work easier and cheaper. Last year, owing to the heavy straw, these engines were shipped from the factory to the grain fields in carload lots by express.

In parts of the country where there is much tile draining to be done special gas engine driven ditchers are coming into use. Some of these are home-made, some factory made. An example of one of the former type came under the writer's observation not long since in Iowa. It is fitted with a fifteen horse-power gasoline engine and is capable of digging twenty rods of trench a day for 36-inch tile at a fuel cost of only five dollars. There are millions of acres of land in this country that need drainage, and it is such machines as these that will make the work possible. If we had to depend upon human labor to do all the excavating the cost would be well nigh prohibitive, even though tile draining doubles and in some cases trebles the value of the land. One of these machines can easily do as much in a day as fifteen men.

The Experience of Farmers with Gasoline

Instances of the use of gasoline engines could be multiplied almost indefinitely. The experiences of farmers everywhere are the same. Listen to what a few of them have to say in regard to this subject. Here is one from Indiana. He writes: "Three years ago I purchased a two horse-power engine to pump water from a hundred and fifty foot well. In the fall we used it to cut corn fodder, then fitted it up to a wood saw and later to run a small feed grinder. If I were buying another engine I would get a larger one, but I only expected to use this one for pumping until I realized its adaptability and added the other duties."

An Illinois farmer reports as follows: "We have three engines on our farm, one is two and a half horse-power, one six and the other eighteen. The small one is used for pumping water, washing, sawing wood and for all small jobs. I got the six horse engine to run the corn dump and to help out the small engine. Later, I converted it into a tractor to more easily take it to the various jobs I wanted done. It is a success, too. The big engine is used to run a feed mill and has ground thousands of bushels of corn and oats for cattle feeding."

A New York farmer, evidently a poultryman, writes that he uses his seven horse engine to run a pneumatic ensilage cutter, a meat chopper and a bone grinder, while a Nebraska farmer who kept an accurate record of his work writes that he sawed eighty four loads of pole wood, each load averaging three quarters of a cord, in fifteen hours and fifty five minutes and used only four and a half gallons of gasoline.

From all parts of the country come the same reports of adaptability, efficiency and economy. We are only at the beginning of the use of power in agriculture, but its use is spreading with tremendous rapidity. The era of power farming is upon us, and it seems destined to work almost as much of a revolution as did the entrance of mechanical power in manufacturing.

Farmers' Bulletins

THE publications of the U. S. Department of Agriculture during the last fiscal year included 2,110 different bulletins, circulars, reports, and other documents, of which 34,678,557 copies were issued. Of these 10,409,000 were Farmers' Bulletins. The series bearing the latter title represents one of the most remarkable examples extant of the activities of a paternal government. It now includes more than 500 titles, running through an almost exhaustively wide range of subjects of practical interest in connection with rural life and industries. For example, during the past year Farmers' Bulletins were issued on "House Flies," "The Use of Concrete on the Farm," "Forestry in Nature Study," "Tuberculosis," "Ice Houses," "Lawns and Lawn Soils," "The English Sparrow as a Pest," and some forty other topics. The publications of this series are all distributed gratis to the public, either directly by the department or through members of Congress, and although they are printed in large editions (from 20,000 to 250,000) the stock on hand is soon exhausted, and many applicants are disappointed.

The Current Supplement

THE Bureau of Railway Economics recently published a bulletin in which a study is made of the capital values and net returns of Agriculture, Manufacturing Industries, and Railways. The salient points of this important bulletin are presented in an abstract which appears in this week's issue, No. 1935, of the SCIENTIFIC AMERICAN SUPPLEMENT.—Dr. A. Nestler tells us many interesting facts about Plants Venomous to the Touch.—The Berlin correspondent of the SCIENTIFIC AMERICAN reports on recent work in "high frequency" moving pictures, in which no less than one hundred thousand photographs are made per second, showing the movement of a pistol lock, and the discharge of the empty cartridge.—Davis H. Tuck makes some interesting comments on the census of power production in the United States during 1912.—A number of industries, such as the manufacture of soaps and candles, make use of hard fats, as distinguished from oils, i. e., liquid fats. To these industries a process for converting liquid into solid fats is most valuable. Such a process is described in an article translated for our readers from a German source.—The capital of British India has by imperial act been transferred from Calcutta to Delhi. Some of the engineering and sanitary problems involved in the construction of the new city are discussed by Sir Bradford Leslie in an article illustrated with fine examples of Indian architectural art, the beauty of which may surprise those who have not made themselves familiar with these matters.—The function of micro-organisms of the soil in agriculture is lucidly discussed by G. W. Moses.

RECENTLY PATENTED INVENTIONS

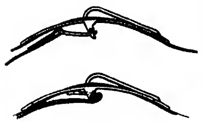
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT HANGER.—L. KALINA, care of Midget Mfg. Co., 178 Center St., New York, N. Y. This invention provides a hanger for supporting coats, vests, suits, trousers, skirts, shirt waists and other garments, and is adapted to be folded into a comparatively small space for convenient carrying in a vest pocket or stowing it in a traveling bag or other similar traveling article.

NECKSCARF.—T. DEWEY and F. J. DEWEY, Plattsburg, N. Y. This invention is intended more particularly for embodiment in four-in-hand and like scarfs in the form of a continuous band or strip of a length to constitute a neck band, and to be formed into a knot, leaving depending flaps or ends.

BUCKLE.—W. J. FRINK, 11 E. 4th St., Chattanooga, Tenn. The invention has for its object the provision of a holding device for a buckle especially designed for ladies belts, which can be attached to delicate fabrics with-

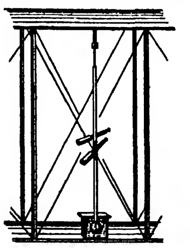


BUCKLE.

out injuring them, without requiring the use of stitches, rivets, pins, or the like and without regard to the thickness of the fabric. The device may be easily attached and detached.

Pertaining to Aviation.

SPEED FINDER FOR MOVING BODIES.—C. S. STANWORTH, 111 Warren Crescent, Norfolk, Va. To facilitate observation by means of this invention fixed lines of sight are laid off at definite angles from a vertical bar and the observer has only to note the elapsed time of the passage of the object across the two lines of sight, and by reference to a table the



SPEED FINDER FOR MOVING BODIES.

speed can be calculated, and the point at which it is necessary to release a projectile or mailbag so that it will strike within a given area can be determined. The principal advantage of the finder is that the lines of sight are fixed angles, and no manipulation of measuring instruments are required. A fragment of an aeroplane is illustrated herewith, showing applied thereto a speed finder.

AEROMOTOR BOAT.—S. S. JEEWAN and F. S. JEEWAN, 21 Convent Ave., New York, N. Y. The invention is an aeroplane having a motor boat attachment so that the aeroplane can alight upon a body of water and propel itself over the surface thereof or be caused to rise from the surface of the water and resume its flight whenever the operator desires.

AEROPLANE.—A. J. A. DEPERDUSSIN, 9 Rue des Entrepreneurs, Paris, France. This invention uses a controlling wheel mounted upon a pivoted bow or bridge of inverted U shape, which spans the width of the fuselage, the ends of the arms of the bow being pivoted at two fixed points on either side of the fuselage, one of the arms of the bridge carrying the cables operating the altitude rudder. Such arrangement permits utilization of the rigidity of the main frames to resist the pull of the cables while the bridge allows room for the pilot's legs. Also, the cables are separated the whole width of the frame, it is therefore convenient to connect them to the ends of the long horizontal arms of the three-arm lever placed upon the landing frame and having a short third arm attached to the operating cables which pass toward the planes over two pulleys located substantially at the same height as the end of the short arm.

Electrical Devices.

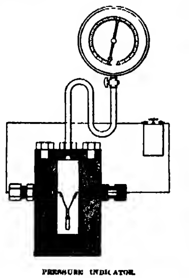
SYSTEM OF ELECTRICAL SUPPLY.—W. C. WOODLANDS, care of Packard Electric Co., Warren, Ohio. The principal object here is to provide a series lighting circuit which is inductively controlled, the system being arranged so that the load may be altered the power factor remaining substantially constant. The system is inductively controlled through the medium of a suitable transformer together with reactances in the primary and secondary transformer circuits.

ELECTRIC SWITCH.—C. E. KNOWLTON, 212 W. 3rd St., Rochester, Minn. The switch shown in the accompanying drawing is of the button type, the buttons being arranged

ELECTRIC SWITCH.

to tilt on suitable journals so as to close or open the double knife switch. The switch is noiseless, and when the current is on the lower half of the button projects from the wall plate. To open the switch the button is tilted back flush with the plate.

PRESSURE INDICATOR.—J. H. WILSON, 15th St. and Center St., Ashland, Pa. This invention is more particularly directed to a device especially adapted for testing the explosive pressure of detonators or blasting caps. The principal object is to provide a testing



PRESSURE INDICATOR.

device whereby the explosive pressure in pounds exerted by a blasting cap or electric detonator will be directly indicated. It provides a testing device of substantial construction whereby the force exerted when a blasting cap or electric detonator explodes may be indicated directly on a pressure gage. The engraving shows in section the operative relation of the device, together with a blasting cap or a detonator suitably held in position therein and in circuit with a battery.

Of Interest to Farmers.

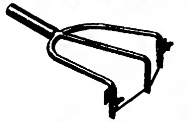
MOWING MACHINE.—A. J. ANDERSON, 22 Greenwich St., New York, N. Y. This machine is self-propelled and is provided with new and useful means for controlling the cutter bar

MOWING MACHINE.

frame. The principal object is to provide a machine having a plurality of bars thereon, the frame carrying the bars being more or less loosely constructed whereby these bars may adapt themselves to unevenness in the ground when the machine is in use. A further object is to provide means for removing the cutter bar driving mechanism out of operative position in order to permit the machine to be run over the ground with the bars inoperative. The illustration herewith represents the machine in a side view.

AUTOMATIC MILK CAN FILLER.—J. W. MULLER, care of G. L. Thacker, Chehalis, Wash. The invention provides a means for filling milk cans, bottles, etc., in succession the milk flowing into the first of a series of cans, and when the first is filled the milk is automatically shut off from this filled can and permitted to flow into the next can of the series, and so on successively to the end of the series of cans.

GARDEN RAKE.—JAMES DICKSON, Box 813, Goderich, Ontario, Can. The principal object of the invention illustrated herewith is to provide an implement adapted to receive



GARDEN RAKE.

a temporary device to shatter or agitate the ground through which it is drawn. This is effected by connecting the tines of the rake with a wire which as the rake is pulled through the ground serves to loosen the earth surrounding plants.

MAPLE SAP EVAPORATOR.—G. H. SOULE, Fairfield, Vt. In this invention use is made of a heater, a pan adjacent to the heater and having a tortuous passage extending from one side at the rear to the front and back to the rear at the other side, inlet connections connecting the heater with the pan at both sides and at the rear of the pan, means for closing either connection and syrup outlets on the pan adjacent to the inlets.

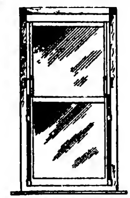
Of General Interest.

SPOOL HOLDER.—M. E. CHESSEY, care of Sanford Novelty Company, Sanford, Maine. A spoolholder is provided in the present invention which may be conveniently attached to the garment of the person and which provides not only a receptacle for a spool, but a

SPOOL HOLDER.

delivery guide for the thread drawn from the spool and receptacle. The device is of compact form and may be readily kept in a work basket when out of service.

WINDOW.—R. B. HARTSFIELD, 210 W. 114th St., New York, N. Y. This invention relates to windows having stiles mounted to slide up and down, and sashes pivoted on the said stiles to admit of turning the sashes on the stiles. The purpose is to provide a window arranged to permit of conveniently turning the sashes with a view to allow cleaning of

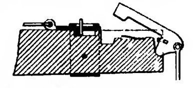


WINDOW.

the outer faces of the sashes from the inside of the room. For this, use is made of a window frame having parting strips of fixed and movable sections and cross-bars carrying the sections and mounted to swing on the sides of the window frame to allow of turning the sashes on their stiles at the time the movable sections and their cross bars are swung into the outermost position. The engraving shows an inner face view of the window.

BOOK LINE GUIDE RULER.—C. E. GOULDING, 1015 S. Dakota Ave., Tampa, Fla. This invention provides a ruler adapted for adjustment of disalined and separate book sections, provides an operating mechanism for rulers to enable them to be adjusted to a margin, provides rulers to hold in adjusted position the open sections of books and to show the continuous line across the two half faces thereof.

HORSE RELEASING DEVICE.—R. E. CHANTRY, Big Arm, Mont. The object is a releasing device with clips to which the tug straps may be secured, the clips being disposed in recesses in the back of the swingletree having forwardly extending shoulders disposed in bearing openings in the swingletree



HORSE RELEASING DEVICE.

and lateral arms disposed in the slots on the swingletree so that the locking slides provided for engaging the back of the clips will hold the clips in position on the rear of the swingletree until the locking slides are drawn back, when the clips will pivot on their shoulders, and the inner ends of the clips be thrown free from the swingletrees. The engraving shows an enlarged sectional view of the end of one of the swingletrees, with the locking slide drawn back to free the clip.

ANTISEPTIC PROTECTOR FOR MOUTHPIECES.—F. A. DIETERICH, 910 Caldwell Ave., Bronx, N. Y., N. Y. The inventor provides a protector for the mouthpieces of telephones, speaking tubes and the like and arranges to present to the user a thoroughly disinfected and agreeably smelling traveling web extending over the entrance end of the mouthpiece with a view to prevent contamination of the mouthpiece and to protect the user against transmittable diseases.

TRUSS.—F. DASSORI, 1115 84th St., Brooklyn, N. Y. This invention is designed for the relief of sufferers of hernia and is so constructed that it will hold any rupture no matter how old, obstinate or recalcitrant under all conditions, and without causing any inconvenience to the wearer.

DAM.—C. BLAW, 505 Pittsburgh Bank of Savings, Pittsburgh, Pa. The object here is to provide a dam preferably constructed of concrete or other suitable material which will possess the maximum amount of strength, rigidity and stability with the least amount of material. A further object is to provide a structure in which the side thrust is resolved into a component, bringing the strain downward.

TRUSS.—F. PUELAN, Apartado 261, Guadalajara, Jal., Mexico. The pads of this truss are mounted on a bar which forms the lower part of a right frame secured to the body by a preferably flexible strap. The frame is so formed that one side thereof projects in a

TRUSS FOR HERNIA.

direction at right angles to the general direction of the bar on which the hernia retaining pads are mounted and is arranged so that the right angle portion will accommodate an abdominal pad which acting against the belt will give a leverage action for properly holding the hernia supporting pads to their work. A perspective view of the device as applied to an abdominal rupture is shown in the accompanying illustration.

REVOLVING CARD STAND.—J. A. MANSON, 347 W. 87th St., New York, N. Y. The object here is to provide a revolving stand so constructed that the display cards may be readily dismounted and replaced. Another object is to provide a stand more particularly adapted to carry display cards such as is described in full in Mr. Manson's copending application Serial No. 661,079, filed November 20th, 1911.

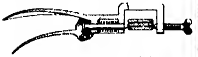
Hardware and Tools.

COMBINATION LOCK.—D. KATZENBERGER, 215 W. Huron St., Chicago, Ill. In this con-

struction the combination can be easily and readily altered without access within the lock case and further it prevents the engagement of the pin or finger with the disk tumblers from being detected in the working of the knob also it provides for the positive actuation of the lock bolt in both directions

LIFTER.—C E Ballow Los Angeles, Cal The principal object of the inventor is the provision of a cylinder lifter having means thereon for rotatably mounting it in position whereby the device is capable of manual operation thereby being adapted for use in places where such an outfit is desirable but where power is unavailable

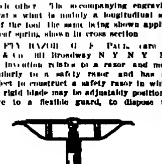
TOOL FOR USE IN OILING LEAF SPRINGS.—H Hutchinson care of Elmer H Lineman Syracuse Neb In this invention the improvement is a tool for use in separating the leaves of elliptic or semi-elliptic carriage springs sufficiently to permit the introduction of oil or other lubricant between them



TOOL FOR OILING LEAF SPRINGS

for the purpose of relieving friction between the leaves and enabling them to slide easily on each other The accompanying engraving illustrates what is mainly a longitudinal section of the tool the same being shown applied to a leaf spring, shown in cross section

SAFETY RAZOR.—G F Paul care of Munn & Co 361 Broadway N Y N Y Mr Paul's invention relates to a razor and more particularly to a safety razor and has for an object to construct a safety razor in which a thin rigid blade may be adjustably positioned relative to a flexible guard, to dispose the



SAFETY RAZOR.

blade at different distances from the guard according to the requirements of the user The engraving herewith shows a side elevation of the invention the upper position being cut away centrally to represent certain portions in section and showing the position of the parts before the blade is clamped into position

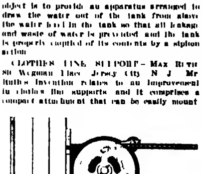
Heating and Lighting

STOVE.—G T Ouseley 3411 S Washington St Frankfort Ind This stove provides for the continuous flow therethrough of air from the room which is to be heated It provides means for causing the soot to be deposited at the top of the stove instead of being carried into the pipe and in such a way that the soot so deposited will be burnt up and destroyed when the stove is in use

Household Utilities.

SIPHON FLUSHING APPARATUS.—J J Meyer 100 Lenox Ave Yonkers, N Y This invention pertains to flushing tanks for water closets urinals and other fixtures and its object is to provide an apparatus arranged to draw the water out of the tank from above the water level in the tank so that all leakage and waste of water is prevented and the tank is properly emptied of its contents by a siphon action

CLOTHES LINE SUPPORT.—Max Ruth 86 Wegman Place Jersey City N J Mr Ruth's invention relates to an improvement in clothes line supports and it comprises a compact attachment that can be easily mount



CLOTHES LINE SUPPORT

ed upon the side of a house adjacent a window thereof and by means of which the clothes line can be readily and conveniently operated to enable the wash to be hung out to be dried and taken in after drying.

Machines and Mechanical Devices.

AUTOMATIC SAW SHARPENING MACHINE.—E. S. Bussy Putnamville, Vt. This machine is designed more especially for grinding sharpening or gumming the teeth of straight or circular saws, and arranged to allow running the machine at a high speed, to quickly sharpen the saw to insure positive intermittent feeding of the saw and positive movement of the grinding wheel to and from the saw and to reduce vibration to a minimum and thus permit accurate and uniform sharpening of the teeth of a saw

HAT FLANGING MACHINE.—T J MacDonald 131 Nepperhan Ave Brooklyn N Y This machine is arranged to enable the operator to reach every part of the brim with a view to facilitate the setting and flanging thereof For this operation the hat block is mounted to turn on the carrier adapted to be swung from a horizontal into an upright position or vice versa

CABLE FOR THE TRANSMISSION OF MECHANICAL MOVEMENTS.—Nicolas Hemsmark 7 Rue de Poliveau Paris, France The purpose here is to provide a flexible cable for the transmission of mechanical movements of all kinds capable of acting by traction without stretching and by contraction without becoming shortened It consists broadly of a core constituted by one or more wires contained in the interior of a tubular helicoidal winding with contiguous spirals, the core being in permanent tension between two stops which bear at each extremity of the cable upon the winding

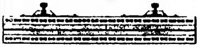
Prime Movers and Their Accessories.

PACKING.—G R. Waight dec'd W A Kruger executor 16 Newberry St Providence R I The object of this invention is to provide a packing more especially designed for use on piston rods, valve stems and the like and arranged to allow convenient adjustment with a view to take up wear For this purpose use is made of a tubular packing made in sections and encircling the rod or stem the sections being provided with conical ends and rings having conical openings engaging the conical ends by holding the sections together and pressing the same against the rod or stem

Railways and Their Accessories.

RAIL FASTENING.—S. B Kill, 150 E 45th St Manhattan N Y The aim here is to provide a rail fastening arranged to securely hold the rail in place and to prevent spreading of the same Use is made of converging spikes, of which one is the rail spike and engages the rail and the other is the locking spike and engages the rail spike to lock the latter against displacement

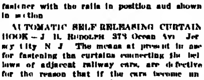
RAILROAD TIE AND RAIL FASTENER.—F C Seaman 3 Academy Place Oneonta N Y The inventor provides improvements whereby the ties are rendered practically indestructible and the rails are securely held in place to prevent them from spreading The tie is made in the form of a skeleton metal casing and a concrete filling and the tie is provided



RAILROAD TIE AND RAIL FASTENER.

with recesses for the reception of rail supporting blocks for the rails to rest upon and rail clamps bolted to the sides of each of the said rail supporting blocks and engaging the corresponding rail at the opposite sides thereof The illustration is a side view of the tie and fastener with the rails in position and shown in section

AUTOMATIC SELF RELEASING CURTAIN HOOK.—J H. Rudolph 378 Ocean Ave Jersey City N J The means at present in use for fastening the curtains connecting the bellows of adjacent railway cars, are defective for the reason that if the cars become uncoupled unless care is taken to disconnect the curtain the parting of the cars will tear or rip the same from their fastenings. The invention provides a fastening hook at the free



AUTOMATIC SELF-RELEASING CURTAIN HOOK

edge of the curtain to firmly hold the same under normal conditions, but which will automatically permit the release of the curtain when a strong pull is exerted on the latter The edge rod of the curtain may be readily inserted and the several parts of the device may be locked to change the same from an automatically releasing hook to a locked hook. The illustration shows the bolt and jaws in protracted position showing the curtain rod.

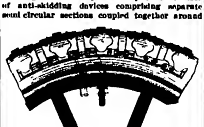
FEED WATER HEATER FOR LOCOMOTIVE BOILERS.—A. Dunnett and C Didier, Santiago de Chile, Chile. The invention consists of a cylindrical feed-water heater for locomotives, which heater is disposed in the smoke-box directly above the passage for the exhaust steam from the cylinders, and is provided with a number of vertical tubes through which the exhaust steam is made to pass. On the top this heater is provided with a concentric conical hood for collecting the exhaust steam, which hood has a mouth piece serving as a blast pipe

CAR DOOR SECURING MEANS.—T H Abernethy Box 172, Shelby, N C. The invention pertains to a car door securing means and more particularly is directed to an improvement whereby the said means when released may serve the purposes of a lever to assist in opening or closing the door

OPERATING DEVICE FOR STATION INDICATORS.—W B Hill, Hotel Seneca San Francisco, Cal The invention is an improved form of a station indicator previously patented by the same inventor A drum is driven from a revolving part of the running gear, and the drum and novel co-acting manually-controlled elements are designed to increase the efficiency and precision of operation and to simplify the adjustment and control

Pertaining to Vehicles.

ANTI SKIDDING DEVICE FOR TIRES.—I D. Meals 306 Cumberland St Harrisburg Pa This invention relates to devices attached to the tread of a vehicle tire for preventing skidding, and more particularly to that class of anti-skidding devices comprising separate semi circular sections coupled together around



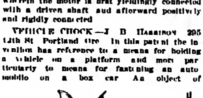
ANTI SKIDDING DEVICE FOR TIRES.

the tire at the tread and sides An object is to provide an anti skidding device consisting of a chain formed of sections as represented herewith in a side elevation of the invention as applied It further consists in novel features of the special automatic coupling link and its appurtenances in the special form of a link uniting the other sections in the chain and in the special form of the individual chain sections

SIGNAL DEVICE FOR VEHICLES.—C F Marston Great Neck Box 113 Cedarhurst L I New York In this instance use is made of a casing for attachment to the rear of an automobile or like vehicle and provided with an adequate signaling means connected with the brake mechanism of the vehicle so that when the brake is applied the signal will operate to inform the operator of a vehicle in the rear that the first vehicle is modifying its speed

GEARING FOR TRACTION ENGINES.—J T Metcalfe and G Metcalfe care of Quincy Engine Co Quincy Pa The object here is to provide a transmission especially adapted for use with explosive engines and capable of a plurality of forward and a reverse speed, wherein the motor is first yieldingly connected with a driven shaft and afterward positively and rigidly connected

VEHICLE CHOCK.—J B Harrison 295 12th St Portland Ore In this patent the invention has reference to a means for holding a vehicle on a platform and more particularly to means for fastening an automobile on a box car An object of



VEHICLE CHOCK

the invention is to provide a holding device which may be adjusted to fit different sized wheels, and to fit the sets of wheels disposed at different distances apart. In the illustration is a side elevation of an automobile mounted in a box car by means of the invention.

ELECTRIC LIGHTING DEVICE FOR MOTOR VEHICLE LAMPS.—H D Grinnell, care of Agricultural Nat. Bank, Pittsfield Mass. This improvement provides a device for lighting acetylene and other gas lamps of automobiles and other motor vehicles, in a very simple and convenient manner without stopping the vehicle or requiring the operator to leave the vehicle

PUNCTURE PROOF TIRE.—W McKay care of Dr I G Burton, 1181 Broadway New York N Y The aim in this instance is to provide a tire arranged to permit convenient assembling of the parts, and to protect the inner tube against being punctured by tacks or the like at the same time producing the desired cushioning effect of the ordinary inner tube tire.

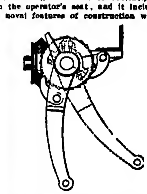
AUTOMATIC TRUCK BODY LIFTER.—L P Cole, Jr., 106 Jefferson St., Weehawken, N J The invention provides an automatic truck body lifter arranged to permit of lifting the body of the vehicle off the truck or chassis and supporting the said body while loading or unloading it, at the same time allowing using of the truck on another body or for other purposes

SPRING WHEEL.—J Luhn, P O. Box 377, Belpre Kan The improvement is in spring wheels, and the object of the invention is the provision of a simple, inexpensive device which while having approximately the resiliency of a pneumatic tire, will be devoid of the disadvantages of such tires.

SPRING CUSHIONED WHEEL.—S W Burckhin R. F D., No 2, Prague, Okla. The invention is an improved substitute for the pneumatic tired wheels commonly used on automobiles, autocycles, and other motor propelled vehicles. It is particularly an improvement in spring wheels in which a pneumatic outer tire is disposed with and an elastic central or hub portion is substituted to provide the required resiliency for the wheel as a whole

VEHICLE WHEEL.—T T Chaloner, 506 W 47th St Manhattan, New York, N Y The invention relates more particularly to a resilient wheel, and the object is to provide means for resiliently supporting an outer rim or tread member Also to provide a wheel structure formed with an outer rim supported by springs and a plurality of resilient plugs projecting beyond the rim

AUTOMOBILE STARTING DEVICE.—F Miskovsky 133 Brownell St., Providence, R I In the present patent the invention is a starting device for automobiles, by means of which the engine can be conveniently started from the operator's seat, and it includes certain novel features of construction which are



AUTOMOBILE STARTING DEVICE.

designed to minimize the liability of accident to the operator in case of backfiring, or the starting of the engine in the wrong direction In the accompanying engraving is a view of a side elevation of the starting mechanism of the device.

SUPPLEMENTAL SEAT ATTACHMENT FOR MOTORCYCLES BICYCLES AND LIKE MACHINES.—C W Duckworth 30 W Adams St Jacksonville Fla The invention provides an auxiliary frame carrying a foot rest and a handle bar the auxiliary frame being connected at its forward upper end with the frame of the bicycle or motor cycle and being yieldingly supported from the rear axle of the machine

Designs.

DESIGN FOR CARPET OR RUG.—J G Peirl, care of G S Squire 41 Union Square New York N Y The border and centerpiece of this carpet or rug design is decorative with geometrical figures of a very ornamental and original style and between these the field is freely patterned with flowers.

DESIGN FOR A SOCK OR STOCKING.—H E. Beers, Lord & Taylor, care of J C Lay 901 Broadway New York, N Y In this design for a sock or stocking the reinforced heel extends upward to double the usual height and ends in an ornamental point.

Note.—Copies of any of these patents will be furnished by the Scientific American for ten cents each Please state the name of the patentee, title of the invention, and date of this paper

Success of the County Agriculturist Plan

By Charles M. Carroll

THAT the farmers of this country are awakening to the necessity of employing modern, business-like methods in conducting their farms if they want to secure the best results, is becoming more apparent every day The rapidity with which County Agricultural Bureaus are being formed all over the United States is the best proof in the world that the men who till the soil are beginning to realize that antiquated methods and old-fashioned ideas have no more place on the farm than in any other field of work.

There are now about 100 County Farm Bureaus in active operation in the different States, as many more have organized, but are not yet employing county agents, while the total number of counties applying for information with a view to establishing agricultural associations is 603.

It was two years ago that the Council of Grain Exchanges conceived the idea of placing an agricultural expert and adviser to the farmers in every county in the United States. The Crop Improvement Committee, with Bert Ball as its secretary, was then formed, and the raising of a national fund to carry on the work was started This fund received a stimulus last spring in the shape of a million dollar donation from Julius Rosenwald of Chicago, who has set aside this sum, one thousand dollars of which is to go to each of the first thousand counties that are willing to co-operate in the work.

Two of the first counties to avail themselves of this offer were Kankakee County Illinois, and Pettis County Missouri While the two counties proceeded along similar lines in forming their associations, each has worked out certain individual details of peculiar advantage to itself The Crop Improvement Committee itself takes no active part in the organization of these Farm Bureaus, each county being left free to act as it sees fit. The committee simply recommends a line of procedure which will enable it and the county committee to make a satisfactory agreement

The farmers and business men of Kankakee County were quickly impressed with the great value of the Crop Improvement Committee's plan, and determined to win the notable honor of being the first county in the United States to qualify for one of the thousand-dollar donations. A few far sighted men behind the scheme had a dream of double crop production—of prosperity resulting from these bounteous yields that should make Kankakee County the best place in the world to live in. The idea caught the imagination of the people of Kankakee County Farmers, bankers, millers, manufacturers, joined hands to raise the money needed to put the bureau on a permanent basis and carry out the other conditions prescribed by the Crop Improvement Committee In less than two weeks more than $10 000 was raised and the organization, known as the Kankakee County Soil and Crop Improvement Association, was incorporated with a capital stock of $50,000.

Prof John S Collier, of the Agricultural Department of the University of Illinois, was engaged as the association's expert. His duties are to advise the farmers, individually and collectively, as to the best methods of cultivating their farms, to point out the troubles and prescribe the remedies, to organize clubs, associations, etc., to give practical farm demonstrations in crop rotation, soil building, farm management. In short, he has been employed by the association to show the farmers how to get more from the same amount of land and how to make what they produce of better quality.

Prof. Collier proposes to plat every farm in the county, and to have a complete history of each, together with a soil analysis. As there are about 2,800 farms in the county it will require some time to complete this task, and he is taking up the farms of the members of the association first.

INQUIRY COLUMN

Inquiry No. 9287 Wanted to buy a machine which will reduce cobs to meal—not a machine for shredding the cobs, but a machine that will pulverize them.

Inquiry No. 9288. Wanted the names and addresses of concerns that can coat steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9289. Wanted substance melting at 325° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oily or fatty vapors.

Inquiry No. 9290. Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes, namely, to fold up bills and insert them with minor coins in a pay envelope of the usual size.

Inquiry No. 9291 Want to buy machinery for manufacturing wooden bowl plates.

Inquiry No. 9292. Wanted, a gum that will stick labels to grape-fruit.

Inquiry No. 9293. Wanted the names and addresses of manufacturers of waterproof cloth, also samples of such cloth.

Inquiry No. 9294. Wanted to buy glass balls [illegible] in diameter.

Inquiry No. 9295. Wanted name and address of [illegible]

The county authorities have contributed the use, rent free, of four commodious rooms in Kankakee's new half million dollar county building as the association's headquarters. There are, in addition to Prof. Collier's private office, a large meeting room, a library containing several hundred books of agriculture, a rest room for the farmers' wives, and a large play ground for the farmers' children. A completely equipped agricultural laboratory has also been established in the Kankakee High School.

As soon as the association had been formed, work was started to form from ten to fifteen co-operators in each township in the county These co-operators send regular reports of the progress of crop improvement in the different townships to Prof. Collier Arrangements are now being made with the National Government whereby domestic science will be made part of the county farm bureau, the work to be in charge of a competent woman who shall make a study of home life throughout the county, and act as adviser to the farmers wives, as Prof Collier is doing with the farmers about their fields.

Usually the soil expert spends the larger part of half a day on each farm, going over each field and giving advice as to its management. Then there are numerous emergency calls to be attended to. One day it is a man who wants to know what to do for corn worms, the next it is a man who wants to know why his rye straw falls down

Another plan of the Kankakee farm bureau is the formation of a seed testing association, which will make it possible to insure clean tested seeds for every farmer in the county The idea is to erect a seed house in Kankakee, equipped with seed cleaning and seed grading machinery of the most approved type that no seed be accepted here except that grown by members of the association under its rules. In this way it is urged that the association would gain national prominence, second to none on earth, on account of the superiority of its seed. The estimate is made that clean and tested seed alone will add half a million dollars to the crop value of the county

The seed testing and seed selection work has been given a stimulus by getting the school children interested in it. By what is called the 'Rag Baby Test,' a ten-year-old boy or girl can quickly ascertain whether seed is good, bad or indifferent It is the plan of the Kankakee County farm bureau to widen the scope of this work among the children and put the little ones in competition with their fathers and older brothers.

The organization of a farm bureau in Pettis County, Missouri was due to the Boosters' Club of Sedalia Early in the history of the club its members realized that anything that could be done for the practical benefit of the county would redound to the benefit of the city, and with that idea in mind they promoted the building of rock roads, better livestock, more extensive dairying and improved methods of marketing

Sedalia is a city of about 21,000, and Pettis is regarded as one of the best counties in the State, having approximately 3,000 farmers whose lands vary in worth from \$50 to \$200 an acre. A close scrutiny of federal and State crop statistics, however, compelled the humiliating consciousness that Pettis County crop yields, particularly of corn and wheat, were much too low Why? Something was wrong What was the cause of this condition and how could it be remedied?

These questions confronted the club, and it decided that the farmers of the county would have to change their methods or quit farming. The conclusions drawn, after careful study, were that what the county needed and should have was the services of an expert, practical farm adviser.

About this time the State Board of Agriculture gave Pettis County a three-day institute date at Sedalia, with M. M. Jordan as the speaker. After hearing Mr. Jordan's lectures on corn and how to in-

crease its yield, the club decided that he was the man they wanted. The result was that they engaged him on the spot at a salary of $3,000 a year. Within six days much more than the required amount to put the bureau on a solid foundation was raised and the Pettis County Bureau of Agriculture was established. It now has a membership of over 500. There is not one of these members who is not of the opinion that should Mr Jordan die to-morrow, the county has already realized in the short space of eight months benefits five times his total cost for a year.

Before Pettis County got Mr Jordan there was a universal saying that "you can't grow alfalfa in Pettis County—we've tried it and know." Mr Jordan didn't believe it and has proved that it can be done. In over 200 soil tests he made, with a single exception, every one was sour—so acid that alfalfa would not grow. He showed the farmers how by the use of lime or ground limestone, 1,000 to 4,000 pounds per acre, their soil could be sweetened, then by thorough preparation and use of good seed they could grow alfalfa. More than forty Pettis County farmers sowed it last spring under Mr Jordan's direction, and in every case an excellent crop was obtained.

Through long continued "corning" of land, robbing the soil, scrub seed and scrubbier culture, the corn of Pettis County ran as low as 25 bushels per acre. Mr Jordan corrected this, all phases of it. He found that adulterated seeds were being sold in the county. He began testing seeds and quickly put a stop to this practice.

At the farms Mr Jordan visited several neighbors would assemble. This suggested holding institutes out on the farm with whole families in attendance, basket dinners and all-day affairs. These were held throughout the county, sometimes as many as 600 people being present on one farm. Frequently return dates were asked for.

Secretary Ball of the Crop Improvement Committee estimates that the amount required to run a county farm bureau will seldom exceed one per cent of the tillable land in the county but not less than $100 for each township.

"We advise raising a local fund of from $2 000 to $5,000 a year for at least two years," said Mr Ball. "There are so many things that can be done to develop the county and make the plan a success if money is available. We are not in favor of running it on the cheapest possible basis. We always advise getting the best man in sight and paying him what he is worth. I know of one county which pays its expert $4,000 a year. He undoubtedly will prove cheaper than the men other counties are hiring at $1,200 a year.

"Any county in the United States is eligible to one of our thousand-dollar donations. There are only three conditions. The citizens of a county must want such service, they must want it enough to be willing to put up part of the cost and to organize for systematic work, and they must contract for the service of an expert for at least two years.

"The National Government has made arrangements with us to go ahead and organize as many county farm bureaus as possible, and as soon as the federal appropriation is available it will take our place in the fund and pay possibly one half the expenses of the farm bureau in each county the second year and thereafter. We are also making arrangements whereby the direction of the county agriculturist will be merged in a State leader, who shall represent both the United States Government and the State Agricultural College."

The Green Tarnish on Lead Pipes

TO remove green tarnish from lead pipes and connections in bath rooms, employ a strong solution of yellow ammonium sulphide. This is harmless, and after its application the pipes should be made sightly by polishing with a dry cloth.

Coming Army Aeroplanes

By C. H. Claudy

After all necessary expenses are paid, and the present aeroplanes of the army provided with needed repairs, etc., the Signal Corps will have about $35,000 of the 1913 appropriation left for the purchase of new aeroplanes. This sum will buy not more than four, and probably not more than three new machines.

The past four years have been largely experimental so far as practical aviation in the army is concerned. The Signal Office, having the work in charge has been more concerned with the development of what was needed with the ascertaining of the possibilities of aviation as affecting the service than in the making of an aeronautical arm of the service fitted for offensive work. Out of the many experiments, the countless flights, the many changes made in machines, certain very definite plans have come into being and certain well defined ideas have grown. These plans and ideas will, in all probability be incorporated in the specifications for new Signal Corps aeroplanes, which will soon be published and on which aeroplane makers will be asked to submit bids.

Definite announcements cannot be made as to the contents of these specifications but it is very probable that the first and perhaps the most far reaching of the new requirements will provide that no aeroplane with a motor developing less than 80 horse-power will be considered. In other words, it is no longer the minimum power and the lightest motor which is desired but the lightest motor which will develop sufficient power to provide for emergencies and permit both speed and carrying ability.

The aeroplanes, which manufacturers will be invited to bid upon, will probably be required to possess stream line inclosed bodies, and this specification will be applied as rigorously to the biplane as to the monoplane. Both for the protection of the aviator and observer from wind and cold and in order to reduce head resistance the inclosed type of body is now thought to be advisable.

Pictures of the Curtiss flying boat purchased by the Signal Corps for army experiments show something of what an inclosed body looks like. The flying boat however has a larger and clumsier inclosure than is wanted on the new aeroplanes, which are not required to be capable of running upon the water.

As revolutionary as anything in army flying machines anywhere in the world, will be the requirement that the new machines be armored. Experiments are now being made to determine the minimum thickness and weight of the finest laminated chrome steel armor, designed for aeroplane use. This chrome steel armor must be thick enough to protect the aviator from rifle fire at a height of two thousand feet or a range of two thousand feet at an angle up to forty five degrees, yet thin enough not to impede the carrying capacity of the craft.

An attempt will be made to equip the new aeroplanes with a radio-telegraphic apparatus, to be supplied by the Signal Corps itself the only requirement regarding it for the aeroplane builder being, perhaps, the incorporation of a generator with the flywheel of the motor and the provision for the carrying of the weight of the apparatus. The Signal Corps has succeeded in sending radio messages from an aeroplane for a distance of fifteen miles. So far no success whatever has been had with attempts to receive any wireless messages in an aeroplane, the noise of the motor, of the chains, when the propellers are chain driven, and the rush of air from the propellers, making the feeble beats of the message in the telephone headpiece completely inaudible. It is not improbable that at some future time some sort of pillowed headdress may, in conjunction with a well muffled engine, permit wireless messages to be received in the aeroplane. But the design will want some working out. It is pointed out that the problem is one of acoustics

and not of an electrical nature, and that any headdress which could be worn in an aeroplane, for noise-deadening purposes would necessarily be both large, cumbersome and in warm weather rather uncomfortable to wear.

It is expected that the new aeroplanes will all be equipped by the makers with a tachometer, a compass, an aneroid, a barograph, a map holder, a pad and pencil holder and a clock, and that the maker will provide the weight-carrying ability necessary to take care of these things. Two-place machines generally are desired for Signal Corps use and a minimum speed of forty miles is probable. Fuel and oil capacity will probably be required for at least four hours flight and undoubtedly the old style of endurance tests will have to give way to the modern idea of cross-country tests. Builders must make machines in which they are not afraid to risk themselves across country, rather than those which they are confident will stand up well in four hours circling of a parade ground. One man control will give way to dual control, so that either observer or pilot can manage the machine and undoubtedly there will be fair restrictions made as to climbing ability and quick starting. Probably the former will not exceed 2,000 feet in ten minutes nor the latter be more severe than is indicated in the ability to rise from plowed ground or a long grass field in 100 yards distance.

Agriculture at Columbia University

GENTLEMEN farmers of New York city are not generally supposed to know much about the actual methods used on their out-of-town places. About all they know is that vegetables are raised on them, are supplied to the table in the summer, and that the cost has not been many times the amount they would have to pay to the country farmer in their neighborhood. When the question arises as to the proper handling of the land under cultivation an expert is called in to give his opinion, a big fee is paid him and the land works well for a few years, when again the expert is called in and the proper treatment is advised again. This is about as expensive a method of farming as could be imagined, yet it is going on all the time on hundreds of country places near New York.

To meet this state of affairs the Department of Agriculture at Columbia is holding a series of lectures by men of scientific training and attainment—in fact by the very men who are called in from time to time by the gentlemen farmers—on Tuesday afternoons up to March 11th, at 4:10 P. M. While these lectures are necessarily scientific, they are divested, as much as possible, of technicalities and the New York farmer may easily learn the proper conduct of his farm. The lecturers are drawn from the national or State agricultural departments and from the schools of agriculture all over the country, many of them having farms of their own upon which the most advanced methods of farming are being carried out.

The aim of the course, which has been arranged by O. S. Morgan, professor of agriculture at the university, is to give chief consideration to the fundamental, practical aspects of the various phases of farming that should be weighed by every farmer manipulating land for crop or animal production about New York city. The competent housewife is always able to secure and keep better servants, so the gentleman farmer, who knows the subject, will be able to make his farm a greater success by use of the facts to be learned at these lectures.

Removing Paint From Glass

TO remove paint from glass a strong and hot solution of acetic acid should be applied with a cloth. As this is very effective care should be taken that the solution does not touch painted wood surfaces. The solution is harmless to the hands and may be applied directly to the glass from a cloth steeped in the solution.

The Planets in February

(Concluded from page 118.)

above, is now easily visible low in the south. A line from Betelgeux in Orion through Sirius, carried as far again, points it out.

The lines in its spectrum are not very strong, and it would be difficult to observe them visually without powerful instrumental aid. Gamma Velorum (Argo Navis) just visible on a clear night, some 8 degrees farther down, is a more promising object for the amateur, for its spectrum is of the "fifth type" and shows a broad bright band coinciding in position with the blue line of the principal series of hydrogen. This is so bright that it can be seen with a direct vision spectroscope placed over the eye-piece of a telescope of moderate size.

The Planets.

Mercury is in conjunction with the Sun—behind him—on the 12th, and is practically invisible during February. Venus is splendidly placed in the evening sky, being at greatest elongation on the 12th, 47 degrees from the Sun, and remaining in sight till 9:15 P. M. With the telescope she appears as a perfect half moon and to the eye she exceeds Sirius tenfold in brightness. Mars is morning star in Capricornus, rising about 5:20 A. M. at the end of the month. Jupiter is also a morning star, but is farther west than Mars, in Sagittarius, and rises about 3:45 A. M. on the 28th.

Saturn is in Taurus, well past opposition, but conspicuous in the evening sky. He is in quadrature with the Sun on the 10th and crosses the meridian at 6 P. M.

Uranus is morning star in Capricornus, and is observable only at the end of the month. He is in conjunction with Mars on the 25th, being 20 minutes north of the ruddy planet. This would be a good time to find him if only the necessary hour of observation were more convenient.

Neptune is in Gemini and comes to the meridian about 10 P. M.

The Moon is new at midnight on the 5th, in her first quarter at 4 A. M. on the 14th, full at 9 P. M. on the 20th, and in her last quarter at 4 P. M. on the 27th. She is nearest us on the 21st and farthest away on the 7th. Since full Moon coincides so nearly with perigee, the tides will run high about that date.

During the month the Moon comes into conjunction with Jupiter on the 2nd, Mars on the 3rd, Uranus on the 4th, Mercury on the 5th, Venus on the 10th, Saturn on the 11th, and Neptune on the 18th, none of the observable approaches being close.

Princeton University Observatory.

Clarifying Beer by Gelatinous Silica

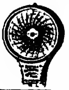
SUCCESSFUL attempts have been made by P. Deprax, according to *Les Ann. de la Brass. et de la Dist.* to clarify beer by means of gelatinous silica, especially those dense beers which are difficult to clarify by the use of fish glue.

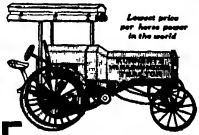
One hundred grammes of the jelly containing 17 per cent of the dry silica are sufficient to clarify one hectoliter of beer in the course of ten hours.

Since large "doses" of this substance may be used without inconvenience the process may be hastened by the employment of a double quantity, in which case the required time is much less. Other advantages of this agent are its very low cost, and that there is no danger of introducing by its use putrescible substances into the liquid to be purified.

The Mississippi as a Conveyer of Material

FROM a large number of analyses of the waters of the Mississippi River it is estimated that the great stream carries annually into the sea during the average year, 136,400,000 tons of dissolved salts, and 340,000,000 tons of mud and other suspended matter—a total of 476,400,000 tons of material extracted by the Mississippi and its tributaries from the rocks and soils of its drainage basin.





Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books *etc* This will greatly facilitate answering your questions, as in many cases they have to be referred to experts The full name and address should be given on every sheet No attention will be paid to unsigned queries Full hints to correspondents are printed from time to time and will be mailed on request

(12737) A A C asks Will you kindly give directions through the Notes and Queries column for filling a barometer tube accurately using only such apparatus as is found in a good high school laboratory? A The usual method of removing the air bubbles from the mercury in a barometer tube is to take a piece of iron wire—No 24 Brown & Sharpe will answer the purpose—and wind one end of it around a short piece of cotton wicking Run this to the bottom of the tube It should pass somewhat loosely so that the mercury will flow past the wicking Now fill the tube with mercury and draw the wire up the tube The cotton wicking will sweep the air bubbles off the glass The wire may be run down the tube and drawn up any number of times till the bubbles are all removed Another way of making the swab has recently been described Wind one end of an iron wire into a spiral which is somewhat smaller than the bore of the barometer tube Into the turns of this spiral pass some soft cotton wicking and proceed as before This seems to be an improvement because the wire will fit the tube better and the mercury will run through the middle of the spiral better than past the wad of cotton as described above

(12738) G F C asks In which of the three classes of levers does the claw hammer belong? A In a claw hammer the power is applied by the hand on the handle of the hammer the weight is the resistance of the nail to be drawn and the fulcrum changes along the back of the hammer as the nail is pulled out This you will see makes it a lever of the first class. If your question refers to the use of a hammer in giving a blow it was not necessary to specify a *claw* hammer and the answer is not the same. The weight to be moved is the head of the hammer The power and the fulcrum are both in the hand If you regard the hammer as moving on the thumb side of the hand then that side of the hand is the fulcrum, and the power is applied with the fulcrum in the middle, and the lever is of the first class If you regard the hammer as moving on the opposite side of the hand as a fulcrum, it is a lever of the third class with the power between the fulcrum and the weight It is wholly as you regard the action of rotating the hammer on the hand The best way to settle such a question is to try it and see Watch some one striking with a hammer Your request for the answer in the *next* issue of the paper is a very common one You will see however that most of the paper must be written some time before it is published It must be set into type made up into pages, proof read and corrected printed folded wrapped addressed and mailed so as to reach the subscriber on the day of publication as it is dated All this takes nearly or quite a week of hard work for the editorial and office forces Only when something very unusual happens is the work stopped to insert it as a special item.

(12739) W B asks 1 Do I understand aright that in the summer months in northern latitudes say Albany the sun rises apparently north of east? In other words that the sun will shine on the north elevation of a building standing directly east and west both morning and evening If so please explain in a layman's vernacular A It is quite true that the sun in the summer half of the year from March 21st to September 21st rises to the north of the east point of the horizon and sets to the north of the west point of the horizon, so that it is above the horizon longer than it is below and the daytimes are longer than the nighttimes. The sun shines near its rising and setting on the north walls of houses which face north and south during all this period. If you have never noticed this you can easily verify this apparent motion by observing the point on the horizon where the sun rises or sets for the next year You will see that point advance toward the north till June 21st and then retrace its path to the south until the 21st of next December The sun is the center of the earth's motion during the year and the axis of the earth is inclined nearly 23 degrees 30 minutes to the plane of the earth's orbit. This causes an apparent shifting of the place of the sun north and south since the axis of the earth is always in the same absolute direction in space, or nearly so The north pole of the earth is directed more toward the sun in June than in December by 47 degrees, or twice 23 degrees 30 minutes. 2 Also explain why although the shortest day is on December 21st the sun begins to set at a later period four days previous, that is, why do the evenings grow longer sooner than the mornings in this part of the year? I inclose copy of calendar which shows sunrise and sunset during December, with notations of length of days in hours and minutes A The second question, as to the change of sunrise near December 21st, is answered by saying that the clock and the sun are together but four times in a year and noon or midday, at all other times is either before or after twelve by the clock. Clocks do not keep the time of the sun which we see, but of an imaginary sun which moves regularly around the sky in a year This is necessary because the real sun does not move uniformly, but is going fastest at this season of the year and slowest about July 1st. Clocks cannot keep with a sun which moves irregularly hence they are made to go regularly and they go ahead or fall behind the sun as may be the case. Only four times in a year are the clocks with the sun There are two causes of this irregularity of the apparent motion of the sun The first is that the motion of the earth around the sun is not regular It is going fastest about January 1st and slowest about July 1st The second is that the day's marches of the earth are reckoned on the equator of the heavens while the earth actually moves in the ecliptic The combination of these two causes produces the result we have described Midday or true noon by the real sun is always midway between sunrise and sunset but 12 by the clock is not midway between sunrise and sunset excepting on four days of the year December 24th is one of those days. The sun rose at 7 17 or 4 hours 43 minutes before 12 and set at 4 43 after 12 The morning and afternoon were of the same length The time by which the clock is away from the sun is called the Equation of Time and may be found in any good astronomy We recommend that you read Todd's New Astronomy which we send for $1 48 You will find all these questions explained in that book and we think you will be much interested in it We are not able to explain these matters except in the language of astronomy although we hope we have avoided unfamiliar technical terms.

(12740) R E P asks I will be obliged if you will answer the following question in your Notes and Queries column Is it better to keep a watch running continually or to let it run down and rest during periods when not in use? A Watchmakers always say that a watch should not be allowed to run down and lie without running The principal reason seems to be that the oil will gum upon the works and when the watch is started it will not keep good time until it is cleaned and oiled

(12741) P S F asks During the night of January 2nd after several hours of rain there fell about four inches of snow here the first snow fall of the winter On top of this snow were thousands of angle worms scattered in some places in other places quite thick One place I counted fifty on a space ten feet square Where did these worms come from? They could not possibly have crawled up through the snow If they did *not* crawl up out of the earth they must have fallen there Is there any scientist that can answer this question or will the answer be just a theory? A We cannot account for the fall of worms as described in your letter Such instances have been reported in other places Small frogs and little toads are said to have fallen as well as worms They may have been taken up in some other places and fallen out of the cloud at your place It is not probable that a scientist can give any better explanation of such a matter than a common-sense man

(12742) R K asks Will you please tell me where I can find information in regard to generating electricity from steam or compressed air or from heat? I have been experimenting with steam but have not accomplished anything practical yet Any information you can give me will be greatly appreciated A All electricity for light and power is generated by the use of steam engines or water power Any book upon the steam engine will be in the line of your question But if you want a book upon the direct generation of electricity from steam or compressed air or directly from coal we must say that nothing has been accomplished in these lines, although much time and money have been spent in the search for such a method of producing electricity In the back numbers of our SUPPLEMENT you will find articles telling of these researches We send you a catalogue, and shall be pleased to supply you with any numbers you may order

(12744) H P asks Will you be kind enough to answer the question below by mail and oblige? Some time ago a corps of engineers in running a line for a railroad came to a point where the needle refused to work, the ground was elevated, and repeated trials brought the same results On the elevated point the needle would dance and could not be kept still or reliable The ground is underlain with iron ore but this has never before affected the usefulness of a compass I would very much appreciate a reply or some explanation A We are not able to explain what you write about the behavior of a compass needle in a certain place over iron ore There is no reason why a needle should 'dance' or refuse to come to rest in such a place, but it would not come to rest in a correct direction It would be deflected to the east or west Nor can we explain why the needle should have been reliable in this place before and not on this occasion A compass needle is usually deviated from its proper position by iron ore in the earth near the surface, but not with such behavior as you describe. The line run by the compass in such positions simply wanders farther and farther away from its correct direction and the error becomes greater and greater till the survey is of no value.

NEW BOOKS, ETC.

ENGLISH LITERATURE MEDIEVAL. By W P Ker, M.A New York: Henry Holt & Co 16mo, 256 pp. Price, 50 cents net.

HERALDS OF THE MORNING The Meaning of the Social and Political Problems of To-day and the Significance of the Great Phenomena in Nature. By Asa Oscar Tait. Mountain View, California Pacific Press Publishing Association, 1912. 8vo, 419 pp, illustrated.

OFFICIAL AMERICAN TEXTILE DIRECTORY, 1912-1913. Compiled by the Textile World Record Boston Lord & Nagle Company 8vo., 664 pp Price, office edition, $3, travelers' edition, $2

We have before taken occasion to mention favorably this textile directory which is published annually in July The present issue maintains the standard of fullness and accuracy that has marked former issues. There are reports of all the textile manufacturing establishments of the United States and Canada together with a yarn trade index and lists of concerns selling to or buying from textile mills. More than 13,000 different concerns are listed there are 23 maps and a vast amount of further information is so presented classified and indexed as to make the work invaluable to those who require some such volume of reference.

MODERN ORGANIZATION By Charles Delano Hine New York The Engineering Magazine Company, 1912 Price $2

In this excellent little book the republication in permanent form of a series of articles on the unit system prepared by Major Hine for the *Engineering Magazine* we have a most interesting and instructive description of the system that Mr Julius Kruttschnitt has introduced on the Harriman Railway Lines comprising about eighteen thousand miles of railway employing between eighty thousand and one hundred thousand men and women and earning annually about $225,000,000 Obviously so vast a system must be most efficiently organized if it is to operate with success That it does operate with success is a matter of common knowledge. How that end has been attained is one of the chief objects that Major Hine has undertaken to set forth In the brief space of this review it is impossible to unfold the method whereby success was achieved. Suffice it to say that it lies in the decentralization of detailed activity and substituting for it centralized control In a felicitously worded preface to the book Mr Charles Buxton Going the editor of the *Engineering Magazine* points out very aptly that the policies advocated are most interesting because they depend so little upon mechanisms of any kind so little upon system affecting rank and file or the equipment and material and so much upon psychological influences operating first upon and then through the directing officials.

THE NEW INDUSTRIAL DAY By William C Redfield New York The Century Company, 1912 Price, $1 25 net

If anyone needs to be convinced that American manufacturers are on the whole a healthy-minded set of men surely the literature on efficiency engineering and scientific management which has appeared within the last few years and which has been eagerly bought and read gives ample evidence of it. Like most of his predecessors Mr Redfield is more philosophic than practical in his treatment of efficiency Therein to our mind lies its chief value No two industries are so exactly alike that the application of efficiency principles to one is a guarantee of their success when applied to the other Therefore what is wanted is an optimistic, stimulating exposition of correct sociological views, a vivid presentation of the relation that should exist between employer and employee and a correct estimate of the debt that the body politic owes to the manufacturer and the manufacturer to the body politic Mr Redfield's book shows how necessary it is to imbue each man engaged in business or manufacturing with the idea that he is but a single element in a vast piece of machinery the perfect operation of which depends in a certain measure upon his efficiency on his sense of social justice, on his conscience.

DACTYLOGRAPHY OR THE STUDY OF FINGER-PRINTS. By Henry Faulds. Halifax Milner & Co, 1912. Illustrated.

In this excellently written book we find a very clear and compact presentation of the whole subject of finger prints, including its history as well as its practical application. The subject is becoming of such increasing importance (finger prints are now used not only by the police for the detection of criminals, but also by the army authorities for the identification of deserters and by banks as a check against forgery) that a popular yet accurate book is really needed. This Mr Faulds has supplied.

MODERN ILLUMINATION Theory and Practice. By Henry C Horstman and Victor H Tousley Chicago Frederick J Drake & Co., 1912. 12mo., 273 pp, illustrated Price, $1 50.

Theory is here everywhere subordinated to the conditions of practice, the aim being to aid electricians architects, and those interested in commercial and industrial establishments, rather than to furnish a text-book for the student or theorist. The material has been arranged with this object in view and the principles of light and illumination are discussed only so far as is necessary to a practical consideration of special conditions. In addition to installation and location of lamps, there are chapters dealing with the color of light, the choice of lamps, the choice of fixtures, and indirect lighting. Apartment buildings, ar-

cades armories studios art galleries ball rooms all have consideration as to the particular system of lighting best adapted to their peculiarities and a table of intensities is appended The chapter on plans and specifications also contains a great deal of valuable information

Le Calcul des Probabilites et ses Applications Par E Carvallo Directeur des Etudes a l'Ecole Polytechnique Paris Gauthier-Villars 1912

In the calculus of probabilities mathematical difficulties are only too abundant To avoid them they must be known The theory of games furnishes all that can be desired in the way of problems since the arbitrary combinations are unlimited Here we have a rich crop of ingenious devices of elegant solutions of surprising paradoxes Fortunately if their attractions are great for mathematicians their utter uselessness is certain for the majority of investigators The author has therefore suppressed entirely the theory of games Only a few examples have been retained which by reason of their simplicity are amenable to definition and to ready explanation Much of the book is devoted to the methods of statisticians Naturally the theorem of Bernoulli plays an important part in the discussion To follow that discussion the reader must be something of a mathematician Yet despite that requisite the book is interesting reading even for the general reader

The Spell of England By Julia de Wolf Addison Boston L C Page & Co 1912 8vo 433 pp illustrated Price $2 50 net

The Spell of England is one of the best volumes of The Spell Series which is saying a great deal Possibly the author's childhood in England is partially responsible for the sympathetic treatment But this must of course have been supplemented by mature observation and judgment before so intimate a description covering so wide a territory could be written The volume is replete with humor as well as with charm Indeed refined characteristic humor has always a charm of its own and there is never too much of it History scenery modern manners architecture—all are treated lightly briefly yet lovingly and the result is a very readable and instructive work The illustrations from special photographs are always a feature of this series and those in hand are fully up to the standard The frontispiece in colors of Caesar's Tower Warwick Castle is a particularly faithful and beautiful reproduction

Roads Paths and Bridges By Logan Waller Page New York Sturgis & Walton Company 1912 16mo 263 pp illustrated Price 75 cents net

Mr Page is director United States Office of Public Roads president American Association for Highway Improvement and a member of the American Society of Civil Engineers With all these qualifications he should be able to impart some very instructive information on a topic of the most vital importance to the country at large And within the scope of so compact a work Mr Page has fulfilled all expectations He truthfully says at the beginning that road building is an art based upon a science A deep knowledge of any art or any science can be acquired only at the expense of years of study and practical application But the farmer and the country gentleman may find even a superficial knowledge provided it be grounded in true principle most useful and beneficial And it is with this particular end in view that the author writes Locations surveys plans and specifications are made the subject of an early chapter This is followed by chapters on the various kinds of roads—earth sand-clay gravel broken stone and macadam Maintenance and repair receive the attention worthy of so important a branch of the subject and a paper on the construction of culverts and bridges concludes a most useful and practical work

The American in Panama By William R Scott 5×7½ in 258 pp 28 illustrations New York Statler Publishing Company

We give our hearty commendation to this interesting and illuminating work by a former employee of the Isthmian Canal Commission The book shows the great advantage we had almost said the necessity of anyone who writes a book about the Panama Canal doing so from the inside and on the spot Mr Scott tells us he discovered that had he followed the usual method of coming into the Canal Zone on the steamer taking notes and leaving on the next steamer he would have missed many fundamental facts which absolutely must be known if a really trustworthy account of the work is to be given He is correct also in his belief that the average American layman desires an authoritative history of the project, and that he particularly desires a non technical review one which distinguishes events from mere incidents and that is not burdened with a mass of details which make it difficult to keep in mind the essential facts. The work opens with a historical review of the history of events at Panama under the Spanish, French and American occupation. Credit is given to President Roosevelt for the great impetus which he gave to this work The author is not pleased with the moral aspect of Mr Roosevelt's settlement of the political difficulties as he makes very clear in a chapter entitled Taking the Canal Zone The development of the work is traced first under Wallace then under Stevens, and finally under Goethals Credit is given to the first two for blazing the way and particularly to Stevens for outlining what is practically the present organization and method of doing the work. Not very much space and yet sufficient for the purpose of the book is devoted to a technical description of the dams and locks and the big cut at Culebra, and the work closes with a very readable chapter on the Monroe Doctrine.

The Scientific American Medal

(Concluded from page 111.)

quently Most of the cases were gas poisoning, but two of the patients were revived from the effects of an over-dose of morphine, two were revived after serious operations, and one case of electric shock was successfully encountered. Public corporations, like the New York Edison Company and the Consolidated Gas Company, put these wonderful machines at the *service of the public day and night* for the purpose of saving life The generosity of some of the large corporations, like the New York Edison Company, in maintaining these life-saving devices for the use of those who are in dire necessity is particularly to be commended, especially in view of the fact that time is everything and the speedy transportation by an automobile must be provided for if there is to be any chance of success

Prof Hutton continued

"The second *gold medal is the gift of* the Travelers Insurance Company, and is for such American employer as has done most for the protection of his work people in limb and life

Such dangers are insistently present in the great electric generating power houses, where energy far surpassing that of the electrocution process is generated second by second and where the human organism is but an atom in the path of enormous mechanical energies For persistent determination to minimize these dangers where engineering and administrative foresight could intervene to prevent them the New York Edison Company has a position in the foremost rank It is for that effort and success as revealed in their many power houses in Greater New York that the Travelers Medal is this year awarded There is also much of mutuality and educational work conducted at the company's expense and availed of in the company's time which while emphatically present in the administration of this company cannot be specifically covered at this time

The third gold medal is the Dr Louis Livingston Seaman gift for progress and achievement in hygiene and sanitation and the mitigation of occupational disease

There are certain industries where the worker comes in contact with poisonous or deleterious substances these are called the dangerous trades and include dusty trades the manufacture of matches lead paint gas and chemical products But even in the strictly mechanical and in noxious productive establishments where many are gathered together communicable disease is always present and the maleficent germs will be conveyed It has therefore seemed to the Museum that it was no less an achievement to clean up a factory than a Canal Zone, and make it a healthy place in which to work.

For their success in securing pure air to breathe pure water to drink, abundant light to work by and personal cleanliness of body, the National Cash Register Company of *Dayton, Ohio,* are *pre-eminent* For these achievements in hygiene and sanitation the Seaman Medal is this year awarded to the National Cash Register Company

"The last gold medal of the series is the gift of the Allgemeine Electricitaets Gesellschaft, Berlin, known as the Rathenau Medal in honor of its distinguished president Dr Emil Rathenau, and is for the best device in the electrical industry for safeguarding industrial life and health"

It was awarded for the Edison safety storage battery and lamp described in our last issue

Dr Hutton's formula of presentation was most impressive.

"By the authority of the State of New York, conferred by charter on the American Museum of Safety, and by direction of its Board of Trustees, as one of the vice-presidents of such board and in its name, I do now confer these medals."

The exercises were concluded by an exhibition of lantern slides showing graphically some of the [illegible] for the awards. The director, Dr. W. H. Tolman, [illegible]

SIXTY-NINTH YEAR

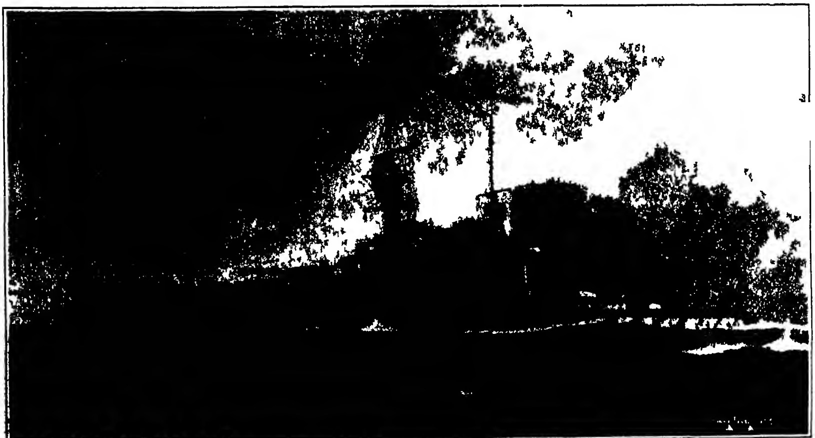
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVIII] NUMBER 6 NEW YORK, FEBRUARY 8, 1913 [PRICE 10 CENTS $3.00 A YEAR

Length, 481 feet Beam, 86 feet Draft 28¼ feet Displacement, 20 75 [illegible] Maximum Coal Supply [illegible] Armament [illegible] Torpedo tubes five Armor [illegible] Speed 20 k[illegible]

N[illegible]w Japanese battleship Kawachi



[illegible] Displacement, 27,500 tons Armament: eight 14 inch guns sixteen 6-inch guns Torpedo tubes five Armor [illegible] upper belt, 7-inch secondary battery 6-inch Speed, 27 knots

"Kongo," one of four powerful Japanese battle-cruisers now under construction.

NEW TYPES FOR THE JAPANESE NAVY.—[See page 138.]

SCIENTIFIC AMERICAN

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are sharp, the articles short and the facts authentic the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

Col. Goethals on the Culebra Slides

IN the course of a recent interview, Col Goethals assured us that he had no anxiety whatever with regard to the more serious problems on the Panama Canal The dam at Gatun is completed practically to its full height, and with a head of over fifty feet of water against the upstream face for the past few months, it has proved to be both stable and proof against seepage, and the central core of impervious hydraulically deposited material is drying out and solidifying satisfactorily The approach wall which had shown a disposition to settle has been straightened and is now secure against any further movement

"But what about the unstable conditions at the Culebra Cut?" "We expect further slides there said the Colonel, "some big slides, in fact and they may occur before I got back to the Isthmus. But they are not giving me anxiety, nor will they cause any interruption to traffic after the Canal is opened I have ordered two floating dredges of fifteen yard bucket capacity, to be delivered in December, each of which can take out from 400,000 to 600,000 cubic yards of material per month."

The expected slides have already occurred. The old Cucaracha slide, which was supposed to be dead beyond resurrection has come to life and sent down 400,000 cubic yards into the Canal burying five of the tracks. Cucaracha is just to the south of Gold Hill and a few days later 500,000 cubic yards of rock and clay broke away from Gold Hill itself, leaving a cliff which is expected to contribute to another half million cubic yards. Purple Hill to the south of Cucaracha, has been weakened' on its north face and another million yards may add its quota from this source A mile or two north of this point another slide has developed, which may send down some two or three hundred thousand cubic yards into the cut

All of which looks very serious, indeed, if we lose our sense of proportion, but if the slides are big, so is the capacity of the excavating plant The steam shovels will keep the prism free until the cut is water filled, and then the two new dredges referred to above, each capable of taking out some twenty tons of material at a single scoop, and removing between them a million cubic yards per month or more, will easily control the situation until Culebra shall finally cease to slide.

State Versus Federal Control of the National Forests

BECAUSE to be forwarned is to be forearmed, the SCIENTIFIC AMERICAN wishes with great emphasis to draw attention to the fact that a strong movement is on foot throughout certain sections of the country, and in Congress itself, to break down the system of national forest protection, by turning the national forests over to the States. Such a movement if successful, would be a blow not only to forest protection, but to the whole movement for the conservation of the national resources of the United States.

One of the finest accomplishments of the Roosevelt administration was the legislation which was designed to protect the national resources of the country and secure their future preservation and wise and equitable development This legislation met the national demand that the private exploitation of the forests, water powers and mineral lands of the country be abolished or at least controlled. It was realized that such control should be exercised, not by the various States in which the natural resources happened to be located, but directly and solely by the Federal Government.

Although the movement in favor of conservation was national in its scope and popularity, it aroused the bitter antagonism of those vested interests, which, under the old conditions were able to acquire and exploit the nation's resources to their own personal and enormous profit The friends of conservation have realized from the very first that it was only a question of time when these interests would join in a concerted and active movement for the modification, if not for the repeal of the recently-enacted laws. At the present time, the agitation has taken the form of a struggle to remove the national forests from federal control and cede them to the States in which they are located. The movement, which has been growing in strength during the past few months, first assumed serious proportions about four years ago, when State versus Federal control of the natural resources was made a plank in many of the State platforms. That great activity is being displayed will be realized when it is stated that during the present Congress fourteen bills have been introduced, which are aimed more or less directly at transferring to the States the natural resources which are now under Federal control The policy advocated in these bills has been openly and strongly supported by many members in Congress.

The sure way to defeat this conspiracy is to give it the widest publicity and inform the general public as to the true facts of the case So far as the national forests are concerned, there are two principal reasons why they should not be turned over to the western States. One is that the step would involve a waste of money and effort, and the other is that the States are not furnished for the task. State control of the forests in the past, indeed, has not only been incompetent, but (and this is a much more serious matter), it has not been done with a single eye to the public interest.

The arguments against State control has a twofold aspect In the first place, the national forests and indeed all national resources do not concern merely the interests of the one section of the country in which they lie Rivers and forests, mineral veins and meadows, the cattle ranges and the public land itself, do not stop at the State line Certainly their administration in the interests of all the people of the country cannot stop at the State line If their usefulness is to be developed to the fullest degree and for the benefit of the whole people and the whole country they must be administered under national policies, decided from the national point of view

The other argument for Federal control is based upon the undeniable fact that, if the natural resources were placed under State control, we should be subjected in an extreme degree to that political spoliation, which has already robbed the country of so much of its birth right

Is it not a significant fact that the most bitter opposition to conservation comes from people who have an immediate or prospective interest in the personal acquisition of timber land, coal water power, grazing, or any other of the natural resources belonging to the people at large? Why are these gentlemen such ardent advocates of State control? Why are they so reluctant to leave the control in the hands of the Federal authorities. Can they blame the country at large if it looks with suspicion upon arguments for State control, which it is asked to believe are based solely upon the abstract principle of State rights?

The Automatic and Inherent Stability of Aeroplanes.

WHILE automatic transverse stability is much to be desired in aeroplanes, fore-and-aft or longitudinal stability is of greater importance, as nearly all the fatal accidents due to faulty stability, occur as a result of diving, which would not happen, or at least would be corrected, if aeroplanes had sufficient longitudinal stability, or if they were provided with suitable devices to bring them automatically back to a level keel Some attempts have been made to construct such devices, and one of them—the Doutre stabilizer—has been found to work fairly well, but of late more attention has been given to designing machines which will have inherent stability to a large degree, and thus will not depend upon automatic devices, which may sometimes fail, for the maintenance of equilibrium.

Early examples of the two methods of producing lateral balance are a V-shaped body and dihedral angle of the wings, typified in the Antoinette monoplane, and the use of a gyroscope as proposed by Maxim and others many years ago.

Recently Elmer A Sperry has brought out a method of automatic operation of the elevator and ailerons by means of compressed air, the air valves being controlled by two tiny gyroscopes weighing 2½ pounds each. Owing to the great sensitiveness of the gyroscope, the aeroplane can be kept on a practically even keel at all times, and also, according to Mr. Sperry, can be given automatically the proper banking on the curves.

Probably the first idea that comes to the average inventor who attempts to construct a system of automatic stability for aeroplanes, is that of the pendulum. A low center of gravity naturally tends to make an aeroplane stable, but the Wrights claimed that in connection with a dihedral angle it would produce rolling, which might become severe enough to capsize the machine. Consequently flexible wing tips and trailing edges were used instead by such men as Etrich, whose monoplane was described in SUPPLEMENT, No. 1933. These work very well, but later developments suggest that the center of gravity can be placed low without the serious consequences predicted In the latest hydro-aeroplanes of the flying boat type, notably the huge machine built by Voisin for M. Deutsch de la Meurthe (which has carried seven men for about an hour), the center of gravity is very low since most of the weight is in the boat-like body below the planes, yet these machines have excellent stability

The Moreau brothers, in France, early began experiments with a pendulum seat for the purpose of working the horizontal rudder and maintaining the fore-and-aft stability Their experiments have met with success for some time past, and the French government has recently purchased one of their monoplanes such as we illustrate and describe on another page. The Wrights also have patented an automatic stability device depending on a pendulum, but it has not yet been put on any of their commercial biplanes. A number of the French military biplanes are equipped with Doutre stabilizers, which also maintain the fore-and-aft stability automatically This device consists of a rectangular vertical plate which is moved back and forth by the varying air pressure, and which operates valves enabling compressed air to set the elevator properly It has been fully described in these columns. The French constructor, Sommer, has recently brought out an improved device of this kind also.

Even better than the aeroplanes equipped with automatic stabilizers are those which are inherently stable, owing to their shape. Foremost among such machines are the biplanes and monoplanes of Lieut. Dunne of England, which have given some noteworthy performances such as flying without human control for a quarter of an hour or more. The Dunne machines are V shaped in plan, the apex of the V being at the front and there being no rudders or tail. The wings slope downwardly to the rear in an inverse dihedral, and besides they have a constantly varying camber from the apex of the V to its ends.

The most recent machine having automatic stability is the Drzewiecki following-surface monoplane which was exhibited at the last Paris Salon This machine is of the Langley type. Its chief point of interest is that the wings forming the following surface are set at a 3-degree less angle with the horizontal than are those of the front surface. The result is as great a lift from the rear plane as from the front one and the production of righting couples that counteract diving and keep the machine on an even keel The machine was designed as the result of experiments made in the Eiffel aerodynamic laboratory It has not been tested to any extent up to the present Mr Robert D Andrews, in this country, conceived a glider along similar lines, and has tested it in small models with encouraging results. His rear surface is placed at a negative angle with the horizontal and the ends of the planes are connected together The principle is different from the Drzewiecki, but the result is similar in the production of automatic stability An account of the Drzewiecki machine appears on page 187, and full details of the experiments that led up to its construction are given in the current SUPPLEMENT

A Bill to Increase Patent Fees

IT is difficult to understand why it is necessary to increase filing fees in patent applications from $15 to $20, as proposed by Mr Bulkley in a bill recently introduced by him in the House of Representatives. Up to the present time about $7,000,000 has been earned by the United States Patent Office in fees, and turned into the Treasury of the United States. Obviously the Patent Office is not in need of money, it more than earns enough to pay for the cost of examining patent cases. If anything, inventors' fees should be reduced, for it is certainly not a function of Government to make money out of a class of men who enrich this country by hundreds of millions of dollars and many of whom begin their careers in anything but easy circumstances.

Record Altitude of a Sounding-balloon.—It is reported that a sounding-balloon sent up from the Observatory of Pavia, the headquarters of upper-air research in Italy, attained the unprecedented altitude of 23.4 miles. The previous record, 20.15 miles, was made at the Royal Observatory of Belgium, June 9th, 1911 The American record, 18.94 miles, was made at Huron, S. D., September 1st, 1910.

Electricity

Wireless to Germany.—The first wireless message sent direct from the United States to Germany was sent on January 17th from Sayville, Long Island and received at the Nauen tower near Berlin, Germany. The distance is about 3,600 miles. Heretofore it has been necessary to relay wireless messages to Berlin and other points on the European continent.

Electrification of London Railways.—The London and Northwestern and the London and Southwestern railway companies are about to carry out an important electrification scheme involving over 150 miles of track in the metropolis. Direct current at 600 volts will be employed, with third and fourth rails, the trains being operated by the multiple-unit system. The scheme includes connection with the entire underground railway system of London.

Huge Electric Clock.—To advertise the Boston Edison Company, a large electric sign has been set up in that city measuring over all 54 feet in width by 60½ in height. The sign contains a clock with the dial 34 feet in diameter, at each side of which are columns studded with electric lamps. The minute hand of the clock is 18¼ feet long and weighs 488 pounds while the hour hand is 14 feet 4 inches long, weighing 386 pounds. The total weight of the structure is 15 tons. Altogether there are 6,322 lamps used in the sign.

Curious Destruction of Fireproof Cables.—In a very serious fire which recently occurred in an English electric generating station certain cables, made with an outside covering of fireproof braid, were destroyed by fire in a remarkable way. The origin of the fire was a comparatively small blaze that had been started by an accidental short circuit. Although this first fire was promptly extinguished, it seems that the short circuit had enormously overloaded the first-mentioned cables, to the point of heating their stranded copper cores red hot. The expansion of the cores rent the fireproof braiding, exposing the rubber insulation underneath to the air so that it burst into flame.

Electrically-driven Ship Machinery.—A new English passenger and freight ship is fitted with electric motor-driven auxiliaries—one windlass, two winches, six cranes and two warping capstans—supplied with current from a central electric generating plant. The machinery was especially designed for the rapid and quiet handling of cargo, and the electric drive gives a greater over-all efficiency than steam equipment, as the prime mover is a single large unit in which the steam is used very economically compared to the waste in the ordinary "donkey engine." Furthermore, the losses in steam pipes leading to each such engine from the boilers, by radiation and leakage, are eliminated, and the equipment does not have to be "warmed up," but is always ready to run.

Wireless Telegraphy Without Ground Connection.—The new wireless telegraph station at Fremantle, Australia, which has just opened communication with Sydney, across the 2,500 mile width of the continent of Australia, is operated without a ground connection in the ordinary sense. On account of the extreme dryness of the sandy soil at Fremantle (there is absolutely no rain during the six or seven summer months, and the underground water is at a great depth below the surface) a satisfactory ground connection could not be established readily. Accordingly an insulated counterpoise is employed instead, constituting the lower element of the electrically vibrating circuit of which the antenna is the upper element. The counterpoise consists of about a hundred insulated wires radiating out from the antenna tower and joined and supported by three concentric circles of wire. The web thus formed is supported on poles which are higher toward the center and lower at the outer edge, making a flattened cone-shaped network which gives an open shape to the vibratory circuit, insuring satisfactory radiation and a more outward reflection of the waves from the counterpoise.

British Electric Welding Practice.—A recent paper on electric welding declares that resistance methods, in which the heat is generated just at the spot where it is required, alone give true welding, every other process, electrical or other, involving the fusing of the two metals together. With an alternating current transformer the current required varies according to the size and nature of the work—from 50 amperes for a small wire welder up to 73,000 amperes on a large tire welder. Resistance welding is simple, accurate, reliable, speedy, and economical in quantity production. Chain links, for example, may be welded at the rate of 10 to 15 per minute. A tire welder can average 525 tires of different sizes per week, and spot welders can make 35,000 welds per week. The thermal efficiency of electric welding is as high as 75 per cent, and the mechanical efficiency attains 93.4 per cent, which compares favorably with hand welding. Iron and mild steel can be welded very satisfactorily, though high-carbon steel (0.6 per cent carbon) does not give as good results. Copper and its alloys, nickel, aluminium, silver, gold, platinum, iridium, and brass do not lend themselves to spot welding and must be butt-welded.

Science

The Unusual Turbidity of the Atmosphere, which began last June and appears to have continued through the summer and autumn, is to be made the subject of an investigation by the U. S. Weather Bureau. A circular requesting notes of any observations that have been made of this phenomenon has been addressed by the bureau to a number of astronomers and meteorologists.

A Prize of 2,000 Marks has been awarded by the German Meteorological Society to Mr. Ernest Gold, of the British Meteorological Office, for the best discussion of the results of the international investigations of the upper air. Mr. Gold, who is only 31 years old, is probably the highest English authority on dynamic meteorology, and is one of the brilliant group of Cambridge men who have given the British meteorological service its present conspicuous position in the scientific world.

The Source of the Kongo.—A telegram from Sakania, Belgian Kongo, announces that the German officer, Lieut. Grätz, who in 1909 crossed Africa in a motor-car, has now accomplished the same feat by motor-boat. The most important geographical result of the enterprise appears to be the discovery that there is a continuous waterway from the source of the Chambezi, in northern Rhodesia, to the River Kongo, which is thus proved to be the longest river in Africa.

Sodium and the Series of Radio-active Elements.—In a recent number of *Science*, Prof. F. C. Brown discusses the evidence that sodium belongs to a radio-active series of elements. "Geophysics," he assures us, "furnishes two distinct lines of evidence which favor the hypothesis that sodium belongs to a series of radio-active elements. The first is based on the age of the earth as determined by radio-active data and by the accumulation of sodium in the ocean. The second is based on the relative accumulation in the ocean of sodium compared to chlorine, taken in connection with the relative annual output of these two elements by the rivers."

New Radio-telegraphic Stations in the Arctic.—In view of the attempts now under way to accomplish the Northeast Passage and the much-discussed question of establishing regular trade-routes by water to the Arctic coast of Siberia, great interest will be felt in both scientific and commercial circles in the announcement that the Russian government is installing radio-telegraphic stations at the entrances to the Sea of Kara, viz. at Vaigach Island, Yugor Strait and Morosola. Hereafter vessels bound for that sea will be able to lie in safe harbor at Vardo or Archangel until they are advised by wireless that the passages are free from ice.

The Plants, Animals and Birds of the Bible have been made the subject of a special exhibition in the Natural History Department of the British Museum, South Kensington, and the trustees of the museum have published an interesting "Guide" to the collection. Among the striking bits of information contained in this work are the following: The common fowl is not mentioned in the Old Testament, and was probably introduced into Palestine after the Roman conquest. The unicorn of the Old Testament was probably the Syrian aurochs, now extinct. That the "behemoth" was not the hippopotamus is made probable by the fact that there is no record of the latter animal in Syria or Palestine in historical times. The "tares" of the Bible were darnel grasses, whose seeds are poisonous, the "rose" was probably the narcissus, while the "lily" was the poppy anemone.

The Recent Progress of Actinometry is discussed by Dr. J. Maurer, president of the International Commission on Solar Radiation, in the recently published report of the last meeting of that organization held at Vienna in September, 1912. For years measurements of solar radiation were made in various parts of the world with a number of mutually incomparable instruments, including some of very little scientific value, e. g., the black-bulb thermometer. The International Meteorological Conference held at Innsbrück, 1905, recommended the universal use of the Angström pyrheliometer, and this instrument has since been employed at most large meteorological observatories, as well as in the course of special investigations, as for instance on various mountains (Monte Rosa, Sonnblick, etc.). Thus science now finds itself in possession of a fairly large body of data on the intensity of solar radiation in different parts of the world obtained by identical and approximately accurate methods, a class of information the need of which has been sorely felt in meteorology. Unfortunately, however, doubts have recently been cast upon the complete reliability of the Angström instrument especially by Kimball, in America, who finds that this instrument gradually deteriorates in accuracy. A more favorable view is taken by Marten, of the Potsdam Observatory, and among others opinion seems to be divided as to whether the Angström pyrheliometer should be retained as the standard. The silver-disk pyrheliometer of Abbot is coming into wide use. Thus the initial problem in the much-needed world-wide study of solar radiation—the selection of a satisfactory instrument—appears to be still unsolved.

Aeronautics

The Automobile Lamp and the Radiator Casing.—In patent No. 1,048,530 Don W. Harlow of Cleveland, Ohio presents an automobile radiator casing which is expanded at its opposite sides in its upper portion beyond the normal outlines of the radiator and sleeves are provided within the expanded portions to receive the lamps so that the lamps are inclosed within the radiator casing.

Another Flying-machine Patent.—In patent No. 1,049,315 Eli Pollak of Washington, D. C., assignor of one half to Edward E. Clement of Washington, D. C., shows a flying machine comprising two longitudinal cylindrical bodies which are connected at their ends to form an elongated integral rigid gas bag or envelope which has a greater width than depth and a longitudinal open space in which a car is hung, the gas bag forming an aeroplane.

Flights in Greece.—Favored by fine weather, Labouret made a number of over-sea flights near Athens and after flying in the neighborhood of Salamis he then came above the Acropolis and the Parthenon at a great height. His performances at the Piræus port were witnessed by great crowds of spectators and also by the ministers of war and the navy. In all these flights he carried two passengers on board, these being the pilots Gimnard and Bernl. The latter is proceeding to join the Epirus army with an aeroplane which he is to pilot. The Greek lieutenants Notaras and Kamberos are embarking with their Farman biplanes in order to join the same army. Lieut. Kamberos lately made some remarkable flights above the islands of the Ægean Sea upon a Farman hydro-aeroplane.

An Incendiary Bullet.—Tests have been made in Germany with a special projectile which is intended to repel dirigibles and which is designed not only to pierce a gas envelope but also to set fire to the gas. This projectile fired from the old German rifle known as "model 71," which has a caliber of 11 millimeters, is provided with little wings that open in flight under the influence of a spring, compressed while the projectile is still in the rifle barrel but expanded as soon as the muzzle is passed. An ordinary bullet leaves such a small hole in an envelope that the gas escapes through it but slowly. The wings on the improved bullet tear a hole of appreciable size in the fabric. What is more, they retard the bullet sufficiently to cause a friction device to ignite fulminate contained in the bullet. It is said that experiments conducted at Neumannswald gave encouraging results.

Another Proposed Transatlantic Flight.—The aviator Beckmann of Cologne, is preparing to make a sensational flight across the Atlantic next spring from Europe to America. He intends to start from the Da Rocha Cape in west Spain and fly across to Ferreira, the first of the Azores Islands, or 1,000 miles. From there he is to attempt the flight across the ocean to Halifax, which will mean about 1,800 miles. He will take on board 2,000 pounds of gasoline and oil, and is to fly for about 11 hours at 90 miles an hour for the Azores trip. Then he will take on 4,000 pounds of gasoline and the flight to Halifax will last 22 hours at a somewhat slower speed. This German transatlantic machine is to be a monoplane of no less than 33 feet in length and 56 feet spread, having a supporting surface of 540 square feet. The weight of the aeroplane is 1,500 pounds, and the framing is of steel tubes. It is to have two revolving-cylinder motors each driving one propeller. Wireless apparatus and search-lights will be carried on board. This may be another case where wireless will prove useful at sea.

News of Buc.—The Buc grounds near Versailles are likely to become the leading aviation center in France. Among the constructors, Esnault-Pelterie, M. Farman, H. Farman and Borel have already installed headquarters on the grounds, and at present Blériot is establishing a model aerodrome of considerable size. The work is, in fact, nearly finished, and the new quarters, built entirely of brick, comprise a main building used as an immense hangar, with two wings of two stories each. The great hall of 170 feet in length is able to house quite a number of aeroplanes, and counting the repair shops which lie at each end, the building is in reality over 300 feet long. In the wings there are installed on the ground floor the offices and a store room with extra parts for aeroplanes, besides a good-sized workshop. On the second floor are the apartments used by the pupils, workmen, guards, etc. Blériot also has dwelling quarters here so as to be able to work when need be. Adjoining the main building are two metallic hangars which already contain several aeroplanes. It is expected to have about 25 aeroplanes in use for instruction of pilots, at the start. Behind the hangars will be built the automobile sheds, and upon the main road is to be erected a monumental entry for the Blériot aerodrome which will cost $35,000 alone. The track of the aerodrome is already traced, and it will be of unusual size. It runs around the Buc fort and incloses no less than 300 acres. M. Collin, who has already trained 250 pilots in the Pau and Etampes Blériot schools, is to have charge of the aerodrome.

The Voice-operated Typewriter

ANALYZE the physical operation of taking down dictation on the typewriter. The dictator pronounces a word, say "met," and within a fraction of a second the letters "m-e-t" are struck upon the machine tremities and separated into four reeds by cutting it apart at the center. It is evident that these reeds would vibrate more or less according to the sound, just as a telephone receiver diaphragm would.

With this crude apparatus, which is shown in the accompanying photograph, the inventor has succeeded in recording on the typewriter all the vowels and the consonant "P." The consonant sounds are much more difficult to reproduce

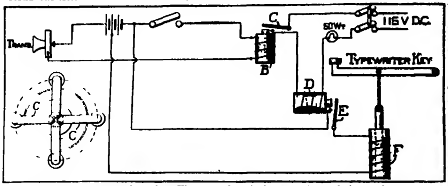


Fig. 1.—Arrangement of reeds. Fig. 2.—Electrical connections of the reed system

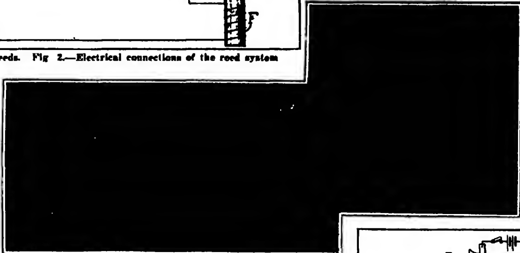
In that brief interval of time the following operation takes place:

The ear drum of the typist is set vibrating as it receives the sound waves from the dictator. Superposed upon the main sound waves are overtones of different frequency, one characteristic overtone for each letter of the word. These waves are communicated to a set of fibers in the cochlea or internal ear. There are many thousands of these fibers, each tuned to vibrate to its own individual frequency. Three of these fibers are then vibrated more strongly than the rest, one after the other to correspond with the m-e-t sounds, and the excitation of these fibers is communicated to the brain which in turn controls the muscles of the typist's fingers, causing them to strike the corresponding keys on the typewriter. No complicated mental processes need be involved in the operation. It is quite mechanical. Indeed, the typist may have been and probably was thinking of something quite foreign to the subject. But if the system is mechanical, why does not some one build a mechanical substitute for the typist, so that the dictator may control the machine by voice without a human intermediary?

Mr. John B. Flowers, a young electrical engineer of Brooklyn, has actually made the attempt and with a considerable measure of success. In his apparatus a telephone diaphragm takes the place of the human ear drum. Instead of the fibers he employs a set of steel reeds, respectively tuned to the different overtone frequencies of the alphabet; for nerves he uses electric currents, and for the human hand a bank of solenoids.

A diagram of the arrangement is shown in Fig. 2. When a word is spoken into the transmitter, the field of the electro-magnet B is varied in accordance with the sound waves impressed on the diaphragm of the transmitter. There are four electro magnets B, and each is fitted with eight reeds, but for purposes of illustration and for the sake of simplicity we have shown only one of the magnets and a single reed C. Although the reeds are tuned to different wave frequencies, they are all vibrated more or less by the variations in the field of the electro-magnet. But as each letter sound is uttered, the reed that is tuned to that particular letter vibrates more strongly than the rest and closes the circuit of the corresponding relay magnet D. This closes the switch E, actuating the solenoid F to pull down the key of the typewriter.

The electro-magnets B are virtually telephone receivers and the reeds C are their diaphragms. Fig. 1 shows how the reeds are mounted at each end of the magnet D. It is as if the diaphragm of the receiver had sectors cut out of it, leaving a cruciform diaphragm mounted on standards at the four ex-



A machine that typewrites what is spoken to it

for the reason that they are of shorter duration, and any mechanical device such as a reed would be too sluggish to respond to them. However, the inventor expects to overcome this defect by using electrical resonators in place of reeds. The arrangement is shown in Fig. 3. In this case the transmitter circuit connects inductively with the resonator mains H and I, across which are connected resonant local circuits, each comprising a balanced inductance K and capacity J. On speaking the word "met" into the transmitter, the three local resonant circuits corresponding to the letters m-e-t are successively thrown into resonance, the current rising to a high value. A small vane of some magnetic material is caused to be pulled into the center of the coil K of those circuits which are highly excited, thus closing the circuits of the solenoids F, working the keys of the typewriter. The electric resonator system has not as yet been put to a practical test, but theoretically it should be very sensitive and quite capable of catching the overtone characteristics of the consonants.

Apparently, then, all that the dictator need do is to speak into the ear of this mechanical typist and his

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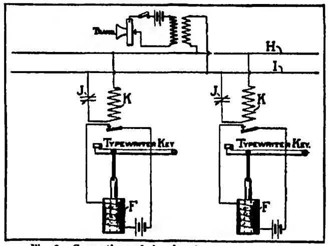

Fig. 3.—Connections of the electric resonator system.

Architecture on the Panama Canal—A Suggestion

NO one who is familiar with our columns would question the friendly spirit in which the criticisms suggested by the two adjoining sketches at the bottom of this page is made. The character of the permanent masonry work along the Panama Canal is such that it does not admit of much architectural adornment or expression, and in view of the magnitude of the huge monolithic masses which constitute the locks, spillways, etc., we think it will be agreed that the simplicity which characterizes these works is appropriate. At the same time, in the designing of the subordinate or accessory structures, such as power houses, range towers or lighthouses for marking the course of the vessels, and the permanent buildings for housing the operating and military forces, we think that great care should be taken to render them architecturally harmonious with the spirit and purpose of this, the greatest engineering work of the day.

The range towers, of which there is a large number placed at intervals along the sailing route of the canal, are concrete structures of circular cross-section and of simple and appropriate design. In the case of one of these towers, known as front tower of range Nos. 1-2 in the Gatun Lake section, it became necessary to make a radical change of form, owing to the peculiar requirements of the site, and the result is shown in the accompanying halftone engraving which is reproduced from the last annual report of the Panama Canal Commission. The tower is situated on the south middle wall of the Gatun locks, which extends from the main structure several hundred feet out into the lake. Upon this wall are located three tracks for electric towing locomotives, one on each edge of the wall, used when the ships are in tow, and a third track to enable the locomotives to return after they have carried a ship through. In designing this range tower, it became necessary to depart from the standard circular form, since the structure had to span the central track with sufficient clearance to allow of the passing of the locomotives.

Unfortunately, the problem was treated as one merely of engineering. Four concrete pillars 20 inches by 24 inches in section were carried up the desired height, arches were thrown in, and a platform was formed above them. From the center of this relatively slight rectangular base rises the massive circular shaft of the lighthouse.

Now, although, from the engineering standpoint, this is a perfectly satisfactory structure, we must condemn

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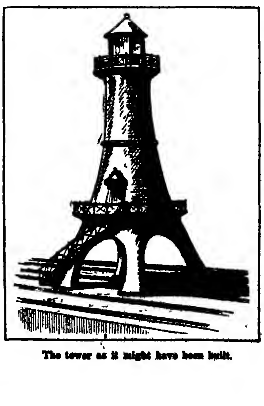
Gatun locks range tower as built.



The tower as it might have been built.

The Moreau Automatically Balanced Monoplane

M. MOREAU of Paris has been testing a monoplane which commands attention chiefly because it is provided with an automatic stabilizer He claims that he has flown thirty-five minutes without touching a lever, steering with his feet. By what the writer saw in a short flight, he believes that the feat is possible in good weather

It has provision both for automatic stability and for personal control The lateral automatic stability is secured partly by the wing shape, partly by the low placement of the mass center These are old and obvious devices which serve in favorable weather and in easy maneuvers. Longitudinal automatic stability is secured by placing the pilot in a pendulum seat shielded from the wind, movable only in a fore-and aft direction, and actuating control cords running back to the horizontal rudder This general pendulum device for automatic control has formed the basis of many patents, but as here applied has some noteworthy features presently to be indicated.

As to the mechanism for personal control, the steering is done by the feet working cords connected with a rear vertical rudder, the lateral poise is effected by ailerons operable by a special lever, the longitudinal poise is obtained by another special lever operating the horizontal rudder All these personal control devices are old and well known.

The most interesting feature of the Moreau monoplane is the combination of arrangements for longitudinal control As already stated, the rear horizontal rudder is operable automatically by the pilot's seat movable only lengthwise of the machine, and manually by a special hand lever But, furthermore, there is a brake operable either by the hand actuating a lever or by the wind acting on a pressure plate, whose function is to lock the pendulum seat so that the whole machine becomes, for the time of braking, as one rigid body Thus the aeroplane is instantly convertible from one having either manual or automatic control to one having only manual control, and in either case it has considerable inherent stability by virtue of its shape and low center of mass.

The pilot-seat pendulum of Moreau's monoplane which has also characterized the designs of other inventors, has the advantage of exerting sufficient force to work the control wires unaided by auxiliary power, whereas the light pendulum controls so frequently proposed, during the past generation or more, for automatic stabilising, require some intermediate mechanism and a special source of power, such as compressed air, or gearing driven by the motor, etc But it may be observed also that the period of vibration of the larger pendulum is longer than need be for a small one, and hence in some circumstances its action may not be quite so prompt. The ideal aeroplane pendulum would always maintain a fixed direction, or, if disturbed, would promptly and without oscillation resume its normal direction, say the vertical Like the magnetic needle, it would be unaffected by sudden shifting or acceleration of its pivot The aeroplane could then be given a definite poise with respect the normal position of its pendulum, with the assurance that the poise would in general be uniform. But the ordinary pendulum when its pivot is accelerated transversely to the line of suspension, promptly deviates from the natural plumb, to which it tends to return for repose gradually after one or more vibrations. The more frequent and prolonged these oscillations, the more unsteady the control of the machine on its course.

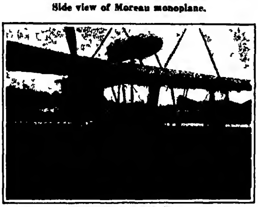
If for example, the aeroplane is accelerated on its path, as when starting along the earth, or when the propeller thrust suddenly increases, the pendulum tends to lag behind, thereby changing the angle of the rudder more, perhaps, than the circumstances require, if any change at all be desirable at the instant. Conversely in landing, when the propeller thrust suddenly diminishes, the pendulum swings ahead of its natural plumb position with a consequent disturbing effect on the evenness of the straight forward flight. But if a brake be available, which automatically locks the pendulum during certain extraordinary accelerations of the aeroplane, due to sudden changes of propeller thrust or sudden wind gusts, these violent movements of the pendulum and their consequent disturbing effects are obviated.

Apparently such a pendulum control should be regarded as a fair weather device. In long voyages it can relieve the pilot during much of the time even if it cannot be depended upon to save him in the most severe atmospheric conditions It may be expected therefore, that if nothing better be forthcoming, the pendulum control will win favor with some aviators, as a convenient auxiliary if not as a life preserver But it must be remarked that although practical automatic controls of various pendulum types, as well as other kinds, have been shown by their inventors to be mechanically operative, they have not made remarkable headway toward general adoption, either by operators or by manufacturers of aeroplanes. These remarks apply to pendulums of ordinary type, whether working the controls directly by their own weight or through intermediary gear involving electric clutches, compressed air cylinders, or the power of the aeroplane motor

In closing reference may be made to an automatic stabilizer governed by an extraordinary pendulum. Mr John Tarbox of Washington has pivoted a bar pendulum at its center of gravity so as to obviate disturbance due to sudden shifting or acceleration of its axis. In order to endow it with a tendency to stand plumb, one end is made bulbous and the whole is immersed in a liquid contained in a box mounted on the aeroplane The pendulum is used to operate a clutch, whereby the power of the motor may be engaged to work the control wires of the aeroplane The Tarbox stabilizer when mounted on a biplane of the Curtiss type enabled it to maintain a level poise in cross-country flying and to fly continuously round a curved course, steadily maintaining a given bank in calm air, and promptly returning to its prescribed poise when navigating disturbed air As witnessed by the writer, in 1911 it was used to control only the ailerons, but it can as well be applied to control the horizontal rudder The inventor claims for this stabilizer all the merits of those operated by common pendulums plus the additional advantage that his pendulum is unaffected in verticality by any acceleration of the aeroplane due to sudden change in the propeller thrust etc as observed for the Moreau machine The correctness of the principle of the Tarbox pendulum may be left to the intuition of the reader or as an exercise for his skill in hydromechanics. The question is Whether a pendulum pivoted at its centroid and more buoyant in its upper than in its lower part will preserve its verticality while its axis is being transversely accelerated?

Three-quarter front view, showing aviator and passenger

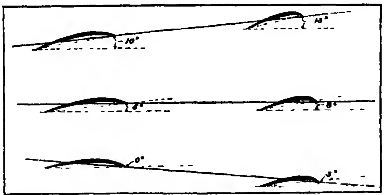
Side view of Moreau monoplane.



Near view of the pendulum seat

The Drzewiecki Following Surface Aeroplane With Inherent Longitudinal Stability

THIS machine is distinctly of the Langley type and it is the outcome of the various foreign machines of the Canard type originated by the Voisins several years ago, and first tried by Santos Dumont in his original aeroplane—the first heavier than air machine to fly in France The Canard type consists of a long body carrying the elevator and vertical rudder at the front end and the supporting surfaces at the rear end The aviator was placed just in front of the planes in the body and the motor was placed at the rear part of the lower plane as in the usual biplane The Drzewiecki machine, however has both surfaces of the same size and both lift about the same amount Both the men and the motor are placed in the body between the two supporting surfaces, while the propeller is located at the rear end of the body behind the second plane The center of gravity is practically at the center of the fuselage half way between the two surfaces. This is important as the position of the center of gravity influences the direction of the correcting couple when the machine tends to lose its balance, and also affects the magnitude of this couple. The machine is balanced in such a way that in ordinary flight the front surface has an angle of 8 degrees, and the rear an angle of 5 degrees There is, therefore a dihedral angle of 3 degrees between the two surfaces in a longitudinal direction The front plane has the profile curve of the No 8 Eiffel surface which gives at 8 degrees, a lift of K_y 0.058 practically while the rear plane has the profile curve of the No 13 *bis* Eiffel surface (Blériot No. 11 *bis*), which gives at 5 degrees a lift of $K_y = 0.01$ approximately Moreover, because of the difference in the two planes, the total lift of the front one varies less quickly than that of the rear when the angle of incidence changes. If therefore the machine gets out of equilibrium or in other words if the two lifts of the front and rear planes no longer balance each other with respect to the center of gravity, and the machine tends to rear the lift of the second surface increases more quickly than that of the front one and a couple is developed that tends to raise the rear of the machine and correct the increase in the angles of incidence of the two surfaces (see diagram) In the case of a dive where the angles of incidence of the two surfaces



Drzewiecki's machine rearing, on even keel, and diving, a difference of 5 degrees between each position

The Drzewiecki tandem monoplane constructed according to results of Eiffel's aerodynamic research.

diminish, the difference in lift of the two planes occurs in an opposite manner, and the greater lift of the front one brings the machine up to an even keel once more.

This principle was tried out in the Eiffel laboratory on a model one tenth the size of a full sized machine. The model was suspended at different angles of incidence and the experiments proved that it is possible to obtain longitudinal automatic stability by the arrangement of the planes shown in the diagram whereby the rear plane is set at an angle of 3 degrees less than the front one. Moreover, it has been proved by experiment that when the planes both have the same angle, the lift of the second one is practically nothing. If the second plane is given 5 degrees less angle than the front one there is no lift at all but rather a downward force. If the second plane has less angle at 2½ degrees than the front one however, the lift produced is practically the same as that of the front one so that in addition to obtaining automatic stability a lift as great or greater than that obtained with an ordinary biplane is to be had. These results were obtained experimentally by Eiffel and M. Drzewiecki constructed his machine in accordance with them. The forward wings can be turned about their axes in order to correct the lateral balance and also to increase or decrease their angle of incidence when it is desired to rise or descend. Each wing is built about a central spar that turns in a ball bearing and they can be operated separately or together by means of two levers. The twin vertical rudders on the ends of the rear wings can be turned inward across the machine at right angles with its axis, in order to form a brake when the machine makes a sudden descent. The motor used is a 70 horse-power Labor and the machine is provided with oleo-pneumatic shock absorbers so arranged that the moment the wheels strike the ground a skid is thrown downward in contact with the soil acting as a brake.

In the pages of the current SCIENTIFIC AMERICAN SUPPLEMENT will be found a discussion of the design from the aerodynamic standpoint.

New Types for the Japanese Navy

By Oscar Parkes

THE sister ships, "Kawachi," which was commissioned last year, and "Setsu," due for completion this year, are Japan's first all big gun ships to be built. Their predecessors, the "Aki" and "Satsuma" although often classed as dreadnoughts, were "intermediates" like the French "Danton" and the British "Lord Nelson" types, as they carried a main armament of four 12-inch and twelve 10-inch guns. The "Kawachi" is the normal development of these ships, and in general design seems an enlarged "Kaiori" with 12-inch guns replacing the 10-inch ones at the four corners of the superstructures, her twelve big guns being distributed after the earlier German fashion, now discarded in that and other navies in favor of the center line arrangement. The "Kawachi" displaces some 20 750 tons, her dimensions being: Length over all 481 feet, beam, 80 feet and maximum draught 28¼ feet. As originally designed she was to have carried fourteen 12-inch guns, with triple turret fore and aft and four twin positions amidships, but this was modified in the earlier stages of construction to twelve guns, twin turrets replacing the triple.

Her secondary battery of ten 6-inch pieces is disposed along the main deck, the end guns being recessed to secure axial fire. The 4.7 guns are mounted at the extreme bow and stern and in the superstructures. Five submerged torpedo tubes are carried, two bearing on each broadside and one astern. These fire the 18-inch Whitehead weapon.

Her protection consists of the usual complete Japanese belt 12-inch amidships, tapering to 5-inch at the bow and stern which reaches to the lower deck. Above this is a 6-inch strake amidships, reaching to the battery deck, and here the guns are behind 6-inch armor. A 3-inch armor deck incloses the engines and vitals. All the big gun turrets are 9 inches thick and are reported to have 12-inch bases.

Both ships are turbine driven the "Kawachi" having Curtis engines and the "Setsu" Parsons. Steam is generated in Miyabara boilers of standard Japanese pattern and the designed horse-power of 25,500 is expected to produce a speed of over 20 knots. The coal supply is 1000 tons normal and 2,500 maximum.

From our illustrations it will be seen that the ships present a somewhat unique appearance owing to the peculiar funnel spacing and the two tripod masts of British pattern. The "Kawachi" was laid down at Kure in January 1909 and the "Setsu" at Yokosuka in April of the same year but owing to financial reasons the last named will not be completed until some time in 1913.

The battle-cruiser "Kongo" is one of a class of four ships of 27 500 tons displacement, and is under construction at the Vickers yard, England. Her dimensions are: Length, 704 feet, beam, 92 feet, and draught, 27½ feet, and she carries an armament of eight 14-inch and sixteen 6-inch guns.

The big guns weigh 80 tons and are 45 calibers long. They are mounted four forward and four aft, the second and third turrets being raised "Michigan" fashion to allow an axial fire of four, and a broadside of eight guns. Along the upper deck are the 6-inch guns, and on the turret tops and upper works are distributed sixteen smaller quick fire pieces.

Official details of the armor and protection are lacking, but reliable information gives the belt as 10-inch amidships, tapering fore and aft and terminating some distance short of the extremities.

Beneath this is an auxiliary belt which is very deep, protecting the ship against under-water attack. Above is a 7-inch strake extending from the first to the fourth turret bases, and the battery is behind 6-inch armor. The protective deck is 2 inches thick.

Her 14-inch guns are in 9¾ inch turrets with armored bases of unknown but probably similar, thickness. Driven by Parsons turbines of 60,000 nominal horse-power the "Kongo" has a designed speed of 25 knots, but 27 knots is expected of her. She carries 4,000 tons of coal and 1,000 tons of oil fuel.

Of the four ships, the "Kongo" was laid down in January, 1911, and is to be completed early in 1913. The "Haruna" (Curtis turbines), "Kirishima" and "Hiyei" are all building in Japan, and are due for completion between 1914 and 1916.

Dussaud's "Cold Light"

REPORTS of the experiments that M. Dussaud, a French savant, has been carrying on since 1909 at his "Cold Light Laboratory," have occasionally filtered into the newspaper columns. These reports, although as a rule exaggerated and perverted, have created considerable curiosity about Dussaud and his work. While the discoveries he has made will not "revolutionize electric lighting," as one recent press story predicted, the truth remains that he has applied some old principles to newly and ingeniously devised lighting apparatus, and has conceived some really startling applications for the latter. On three occasions communications by Dussaud have been presented to that august body, the French Academy of Sciences, by Prof. Branly of wireless telegraph fame.

Dussaud's apparatus, in its most typical form, consists essentially of the following parts.

1. A disk or wheel, with suitable mechanism for revolving it.

2. A number of tungsten filament lamps (usually 16 of them) spaced uniformly around the rim of the wheel. The lamps have small, closely coiled filaments, the whole filament structure in a single lamp occupying only 10 cubic millimeters, whereas the filament of an ordinary tungsten lamp encompasses a space some 2,000 times as great. The bulbs are small and round similar to those commonly used in automobile headlights. A battery or low voltage dynamo or transformer supplies the current.

3. A commutator, keyed to the shaft of the wheel which causes each lamp successively to be lighted, for about 1/20 of a second only, as it passes a certain fixed point near the periphery of the wheel.

4. A projecting lens so designed and placed as to receive the light rays from the lamps, as each in turn passes by the fixed point where it is lighted.

For most purposes (moving picture machine work for example) the wheel is revolved at a speed of 16 or more revolutions per second, so that the optical effect, due to persistence of vision, is that of a single steady continuous light emanating from a point. For other purposes, as for example, in light house beacons, the wheel is revolved more slowly, so that the light is seen to be a succession of flashes.

M. Dussaud finds it possible, by making the apparatus of little inertia and using special mechanism, to stop the wheel during the twentieth of a second or so that each lamp is alight, so that the filament, while lighted, remains stationary at the exact focus of the lens. In the case of lamps with fairly large bulbs, when necessary he mounts the filament off center, thus bringing it near enough to the inclosing glass of the bulb for the little incandescent coil to be in focus.

There may seem to be nothing startling in all this, but now comes the spectacular part of the performance. Using the apparatus above described, Dussaud finds that *more than twice* their normal voltage can be impressed on the lamps, yet they will last for several hours, while the light is obtained at an economy of electrical energy absolutely unknown with any other illuminating device using incandescent lamps. Thus, by doubling the impressed voltage, a lamp normally requiring 1 watt per candle-power is made to deliver light at an efficiency of 0.3 W. P. C.! He actually impresses 2½ times the normal voltage in certain applications of the apparatus, such as medical examinations of interior parts of the body, and thereby raises the efficiency to 0.1 watt per candle, making a light twice as efficient as that of the yellow flaming arc.

While the efficiency is increased by "overvolting," the candle-power obtainable from a given bulb is increased in still greater proportion. Thus a 200 per cent of normal voltage, a ten candle-power lamp, with a bulb less than two inches in diameter, emits a light of over 140 candles.

There are two advantages in Dussaud's scheme of using several lamps in rapid rotation, rather than a single lamp continuously. In the first place, the life of each filament is increased about twenty fold, since it is in commission only one twentieth of the time. Secondly, the bulbs do not have a chance to get hot, a fact of great importance when they are used close up to moving-picture films or expensive lenses. Thus the light is a "cold light" in a double sense, very little heat is evolved in proportion to the light delivered, and even that little is so thoroughly dissipated that the apparatus remains cool.

The light intensity in a given direction may, of course, be increased by the use of a reflector in addition to the concentrating lens. Dussaud has two forms of apparatus employing reflectors, in one form the reflectors are rigidly attached to the lamps on the wheel, and revolve with it, in the other form there is a single fixed reflector mounted coaxially with the concentrating lens.

The distinguishing principle of Dussaud's "cold light" may best be stated in his own words.

"This method dissipates the objectionable *heating effect* of the electric current over a *maximum surface* where it offers no inconvenience, and concentrates the useful *luminous effect* on the minimum surface where it is needed."

With a consumption of only 160 watts of electrical energy—which will not produce even the smallest commercial arc light—Dussaud's apparatus produces results in projection work that would be impracticable with even the largest arcs manufactured.

The *applications* that Dussaud has discovered for his invention have done more to bring it into public notice than has the mere fact that the light is surpassingly efficient and intense. And the man is no dreamer. Already he has induced the French Minister of Instruction to give the "cold light" a thorough try-out in the public schools in connection with educational moving pictures exhibitions, while the Minister of War is considering its applicability to military search lights.

Owing to the comparatively high expense of bulb renewals with the Dussaud system, as well as the necessity of moving parts, one is inclined to view with incredulity any claims that it will ever find much favor as a general illuminant, although the inventor rather naively suggests that it may be used with hollow inverted reflectors to produce beautiful indirect lighting effects in drawing rooms, conservatories, etc. Its province seems rather to embrace several specialized applications of electric lighting, to the development of which he is wisely confining his attention.

Among these special applications is that of endoscopy or examinations of the internal organs of the body. So intense is the light that, when it is placed under the hand the finger bones and principal blood vessels are clearly seen. In many cases it is believed that this powerful, cold light will enable bullets and other foreign substances to be located without the necessity of an X-ray examination. Letters can be read, it is said, even when wrapped in a dozen thicknesses of note paper and inclosed in an envelope.

A second application, already mentioned, is that of cinematography. Dussaud claims that his apparatus will do away with the cumbrous moving picture machines and asbestos-lined cabinets now in use. No shutter will be necessary to cover the lens during the interval of 1/64 of a second between two successive pictures, for that can be taken care of by the commutator, which causes the incandescent lamp to be extinguished during that interval. Moreover, the present commercial dimensions of the positives, 8½ × 10 centimeters, can be reduced to 19 × 24 millimeters, owing to the possibility of using lenses of shorter focus, in fact, the "pocket moving picture machine" is seen as an imminent possibility. The cost of the lamp bulbs with the Dussaud machine is about equal to the cost of current with an arc, but a considerable saving is said to result on account of the smaller investment with the former.

Paradoxically, the Dussaud "cold light" is produced at an unusually high filament temperature; indeed it is that very fact that makes the "cold light" possible. As high-temperature radiation is rich in the shorter wave lengths (blue, green, violet, ultra violet) which are chemically the most active, it follows that the new light is a good one for photographic purposes, such as the making of silver prints. For flash-light photography it can be used on many occasions when magnesium powder would be considered a nuisance.

M. Dussaud is experimenting with a "cold light" machine in which the lamps and optical system are of quartz instead of glass, in order that the chemical and pathological effects of the ultra-violet rays may be studied.

Recent reports indicate that Dussaud's "concentrated cold light" has another field of practical usefulness in light-house beacons.

Shall We Build Battle Cruisers?

Every Big-gun Cruiser Would Mean One Less Battleship in the Fighting Line

By R. D. Gatewood, Naval Constructor United States Navy

1. There can be no doubt that there are many adherents of the new and very interesting type of ships that has recently come into being, variously termed "battle-cruisers," "cruiser-battleships," and "high-speed-battleships," and that there is considerable criticism of our Navy Department, both in this country and abroad, for not building them It would be difficult to say whether this be due to the fact that other powers have them and we have not, or that the type with its greater size and speed, and its powerful guns, appeals to the popular mind, or that we really do need them.

2 Involving as it would a change of policy and a very large expenditure of money, let us consider the matter from every viewpoint before answering the question that forms the title of this article.

Type

3 These vessels first came into being in 1906 with the British "Indomitable" class. To-day both England and Germany have battle-cruisers in considerable numbers, and are building more. Japan is building four We, however, have none nor are any yet projected.

4 Battle-cruisers differ from contemporary battleships in three main factors

(1) Greatly superior speed

(2) Slightly inferior battery

(3) Greatly less protection.

An examination of Tables I and II taken from Jane will make this quite clear It will be noticed that while the standard battleship speed stands at about twenty-one (21) knots, the battle-cruiser speeds are from thirty (30) to forty (40) per cent higher The size of guns in both types is the same but the cruisers carry fewer of them. The armor belt, which is nine inches on the latest British and German ships, is not only much less in thickness, but is spread over a less area and is tapered more at the ends than is the case with battleships.

5 Future battle-cruisers will almost certainly maintain these differences, and any that we design will in all probability be built to have a radius of action greater than those of other countries, since our strategic position is such as to require this. If we adopt this type, we may therefore expect to have even bigger and more costly ships than any other nation. Assuming that we decide to build such vessels with a speed of thirty (30) knots, an armor belt of eleven (11) inch thickness, eight (8) 14-inch guns, and a radius of action of eight thousand (8,000) miles, a fair estimate of the cost of a single vessel would be twenty million dollars ($20,000,000), and this, of course does not include the large incidental expenditure involved in deepening channels and enlarging docks which would be necessary

6 To be of any real use, either tactically or strategically, at least four of such ships, or one division should be authorized, and not a single unit Just here it is interesting to reflect that any vessel appropriated for in 1913 could not join the fleet before 1916. At that time, assuming that we build two capital ships per year from now on, the situation will be

	Japan	Germany	United States.
Battleships	6*	17	11
Battle-cruisers	7	8	0
Battleships, Second class	13	12	24

Thus, even if two battle-cruisers should be added to our fleet by 1916, they would be opposed to eight similar cruisers of Germany, or seven of Japan, and it is difficult to see how so small a number could accomplish anything.

Uses.

7. In considering now the uses to which this type may be put we naturally consider them under the three heads: (1) Before action. (2) In action. (3) After action.

(a) *Before Action.*—There is no question that they would be very valuable for quickly reaching a sea out let, or occupying an advanced position of importance or relieving a threatened base, or re-enforcing another fleet in a given time all of them rôles requiring high speed as well as offensive power

They would be useful as scouts but here several things are likely to be overlooked. In the first place, the maximum speed of one of these cruisers cannot long be maintained on account of the excessive coal consumption. At full speed, they will probably burn the equivalent of one thousand (1 000) tons of coal per day Also it is very questionable whether any commander in-chief would care to detach far from his battleships vessels that could deliver such powerful blows in the fighting line Then, too, for anything but distant scouting the aeroplane is undoubtedly going to be superior to any ship. The strong claim made for

TABLE I—BRITISH ARMORED CRUISERS

Name.	Length	Breadth	Displacement	*Speed	Horse-power	Main Battery	Secondary Battery	Belt Armor
	Feet.	Feet	Tons					Inches.
Indomitable	562	78½	17 250	25 0 26 7	41 000	8 12 in	16 4 in	7
Invincible	562	78½	17 250	25 0 28 6		8 12-in	16 4-in	7
Inflexible	562	78½	17 250	25 0 28 4		8 12-in	16 4-in	7
Lion	660	88½	26 000	28 0 31 7	70 000	8 13 5-in	20 4-in	9
Princess Royal	660	88½	26 000	28 0	70 000	8 13 5-in	20 4 in	9
Queen Mary	725	87	28 858	28 0	80 000	8 13 5-in	4 in	9
Indefatigable	580	79½	19 200	25 0 29 1	43 000	8 12 in	20 4 in	8

* Upper line designed lower line on trial

TABLE II—GERMAN ARMORED CRUISERS 1909-1912

Name	Length	Breadth	Displacement	*Speed	Horse-power	Main Battery	Secondary Battery	Belt Armor
	Feet	Feet	Tons					Inches
Von der Tann	561	87	19 100	27 6 28 0	71 000 80 000	8 11 in	16 24 pdr 10 6-in	7
Moltke	590½	88	21,800	28 0 28 4	70 000	10 11-in	12 6-in 16 24 pdr	7½
H	590½	88	21 800	28 0	70 000			
J	590½	88	21,800	28 0	70 000			
K			23 000	28 0	90 000	10 12 in or 8 14-in	12 6-in	9

* Upper line designed lower line on trial

GERMAN BATTLESHIPS 1908-1912

Name	Length	Breadth	Displacement	*Speed	Horse-power	Main Battery	Secondary Battery	Belt Armor
	Feet.	Feet.	Tons.					Inches.
Rheinland class	472	89	18,600	19 5 20 2- 20 7	20 000	12 11 in	12 6-in 16 24-pdr	9¾
Helgoland class	492	93	21 000	20 0 21 1- 21 3	25 000 34 000	12 12.2 in	14 6-in 16 24-pdr	10¾
Kaiser class	510	97	23 000	20 0	27 000	10 12 2-in	14 6-in 16 24-pdr	14¾

battle-cruisers for this short range scouting is that, when used in a screen, they can drive in the scouts of the enemy and prevent them from getting valuable information, and they may even be able to force an action where the enemy is unwilling to engage

(b) *In Action.*—When the action is actually joined they would be very useful in obtaining a position at the head of the enemy's column, opposing his weak end on fire with their powerful broadside fire and thus 'capping' his column, as it is called, and forcing him to change his course. Or they might be used in the much talked of, but never used, formation of the "fast wing," which is simply a detached body available for threatening the head or rear of the enemy's column or a weak point in his line.

(c) *After Action.*—Assuming that these cruisers have preserved their speed after the battle which on account of their light armor could probably only be done by keeping them out of it, there could be no doubt that they would be of great value in the pursuit of a damaged and retreating enemy either in heading him off harassing his flanks, or in reinforcing pursuing destroyers.

8 The above is an outline of the probable uses that would be made of this type by the powers possessing them. Should we attempt any of them, however it will be at once seen that against any probable enemy we will be hopelessly outnumbered. Also, in all the great naval battles at Aboukir, Trafalgar Lissa, Yalu Manila, Santiago, and Tsushima, there has always been a very decided attempt to force the issue of the action in the shortest possible time by massing the attack of all possible units, and I believe that in the last analysis, any such cruisers as we might construct would, of necessity, operate in the line of battleships.[*]

Conclusions.

9 England is building this type because she already has an extremely powerful navy in conjunction with which they can be used to the best advantage and also because she needs them to protect her rich and widely separated colonies. Germany is building them because England is, and because she seems able to afford both battle-cruisers and battleships at the same time Just why Japan is building them at the expense of battleships is indeed difficult to see, but that country has four powerful battle-cruisers of the Kongo type, as illustrated on the front page of this issue

10 For the United States it must be clearly understood that such cruisers could only be constructed at the expense of battleships. We cannot have both and from the above it is seen that we cannot have the cruisers without a very great expenditure direct and incidental Under no circumstances should we jeopardize our chances of keeping our battleship fleet up to an adequate standard, and until we can maintain that, the battle-cruiser is a luxury that we can ill afford

The Technical Experiment Station of Vienna

WE have received the following communication from the Technical Station of Vienna

"This station plans to prepare a directory of all technical experiment stations at home and abroad

"For our records we require the following data

Statement of the special field covered by the experiment station address, name of owner, director and employees, date of erection, furthermore statement as to whether the institute is independent, or is connected with an institution for technical instruction, or with a factory company or other industrial enterprise, whether the institute is open to the general public, or has been installed only for private practice lastly, details regarding the installation and size of the institute

All technical testing stations, except ing those who have already communicated with the undersigned are, therefore requested kindly to make early response to this inquiry

"The Imperial Testing Office is also prepared to receive information regarding new developments and departures in the field of technical testing

"THE IMPERIAL AND ROYAL TESTING OFFICE,
January, 1913 EXNER, *President*."

Using Ice to Save Apple Trees

A MARYLAND orchardist has found that the balmy spring like weather prevalent this winter in some sections of Maryland promises to cause a premature blossoming and budding of his apple trees, and is said to have purchased a hundred tons of ice and cracked or broken the same into small pieces which he has packed about the roots of the trees to produce in this manner a temperature which will retard the blossoming of the trees It is a common expedient to heat orchards to prevent injury by frost, but this is believed to be the first instance where artificial cooling has been resorted to The orchardist declares that if the warm weather continues, the apple and peach crop in his section will be considerably reduced if not entirely destroyed unless some means are resorted to to prevent the premature blossoming.

[*] In this connection it is interesting to note that the official name recently given to these cruisers in Germany is Linienschiff Kreuzer, or cruisers of the line.

Photographing from a Skyrocket

IT takes an active imagination, surely, to see any sympathetic relationship between a skyrocket and a camera—so delicate is the one, so boisterous the other, but the feat was not beyond the powers of Mr Alfred Maul, who has linked the one to the other in a happy co-partnership the results of which are shown in the accompanying excellent photograph taken by his device

The rocket-camera as it might be called, was designed for military purposes and was demonstrated before the German military authorities with such success that it has been officially accepted. The problem was not an easy one and the inventor claims to have been trying to yoke up these two very dissimilar things for some twelve years, for it has taken that time to bring the device to its present undoubted perfection

The accompanying illustrations, for which we are indebted to the *Illustrated London News*, show the construction of the camera-carrying rocket, the method of mounting and firing it, and the way in which it is knocked down and packed on a light handcart for transportation The apparatus is described as consisting of a camera held in a pointed hood, at the top of which is a pneumatic electric contact, and a holder which contains a parachute and the upper part of the rocket. On the top of the holder is a gyroscope which serves to maintain the camera in the desired position for the snapshot The stick of the rocket is about fifteen feet in length, and it is fitted at its lower end with wooden feathers. The whole rocket is twenty feet in length and it weighs about eighty four pounds. The camera is capable of taking eight by ten inch plates.

For giving the proper direction in firing the rocket is mounted in a special form of 'gun-carriage' which is mounted at the apex of a stout triangular base and is capable of being elevated through any range from the horizontal to ninety degrees. When the rocket is fired electrically (from a distance of about 200 yards) the gyroscope is started, and, in about eight seconds' time the rocket with the camera reaches a height of about 2000 feet When the rocket is turning at the highest point of its trajectory the camera being held in the proper direction, covering the field of view, by the gyroscope the camera shutter is released and the photograph is taken At the same moment a parachute, which forms part of the apparatus in the head of the rocket, is set free and the rocket divides into two parts The parachute opens and the whole of the mechanism rocket head, etc drops gently to the ground landing in about fifteen minutes. We reproduce some of the photographs which have been taken with this instrument, and they are so sharp and clear in definition, that they could not fail to give valuable information regarding the strength and disposition of the enemy's troops, artillery and earth works.

Königsbrück, photographed from a rocket

The military rocket-camera knocked down for transportation.

The rocket head, the stick with wooden feathers and the frame

Rocket photograph of Steuz village under snow.

By Courtesy of the Illustrated London News

Laussnitz village photographed from a rocket.

The camera-carrying rocket in its frame ready for firing.

A snapshot of the rocket at the moment of firing.

The parachute bringing apparatus to earth.

ROCKET PHOTOGRAPHY

The Enlargement of the Aswan Dam

By the English Correspondent of the Scientific American

THAT great engineering work, second only in magnitude to the original construction, the enlargement of the Aswan barrage across the Nile, has been completed. The work has been in progress for nearly six years, and although of a somewhat delicate character, it has been carried through to completion without a single untoward incident.

When this barrage was first contemplated Sir William Willcocks, the eminent irrigating engineer, recommended that the great wall across the river, 1 21 miles in length, should be of sufficient height to impound the water to a level of 114 meters (380) feet above sea level, the maximum head of water thus obtained being 26 meters (86 feet), whereby the volume of water stored would amount to 88,300,000,000 cubic feet in round numbers. This seems an enormous volume, but it was only a little more than fifty per cent of that actually required to meet the needs of the country which could be served.

Unfortunately, public opinion demanded the reduction in the height of the barrage, and the Egyptian government responded to the popular outcry However, the amended work was designed in such a manner that, if the exigencies arose, the wall might be heightened by 6 meters (20 feet) with perfect safety

After the barrage was opened and the widespread benefits that were bestowed by the scheme became recognised, the mistake in reducing the height of the structure was appreciated. The question as to whether a greater volume of water might not be impounded by raising the crest of the barrage was discussed. Sir Benjamin Baker stated that such an end could be achieved with complete safety, if carried out upon the lines he laid down He prepared the plans for the alterations, which involved increasing the height of the barrage by 5 meters (16.6 feet) and augmenting its thickness also by 5 meters. In this way the water level would be raised by 7 meters (23.4 feet), whereby the volume of stored water would be increased from 35,800,000,000 to about 81,200,000,000 cubic feet

The contract, which was estimated at $7,500,000, was handed over to the well-known British contractors, Sir John Aird & Company, who had been responsible for the original works, and to whom we are indebted for the permission to describe and illustrate the alterations. The important problem was the bonding of the new with the old work Sir Benjamin Baker recommended that, in building up the new part of the masonry, a space ranging from 2 to 6 inches should be left until sufficient time had passed to enable the temperature of the old and new masses to become equal, when they were to be connected by cement grouting.

Accordingly, the new work was built up in front of the old, and was not connected to the latter except by a number of steel rods of 1¼ inch diameter and 8 feet in length, sunk to a depth of 4 feet into the old work, and disposed at intervals of about 3 feet 6 inches. Extreme care had to be exercised to keep out moisture, and also to prevent débris from falling and collecting in the space between the two sections.

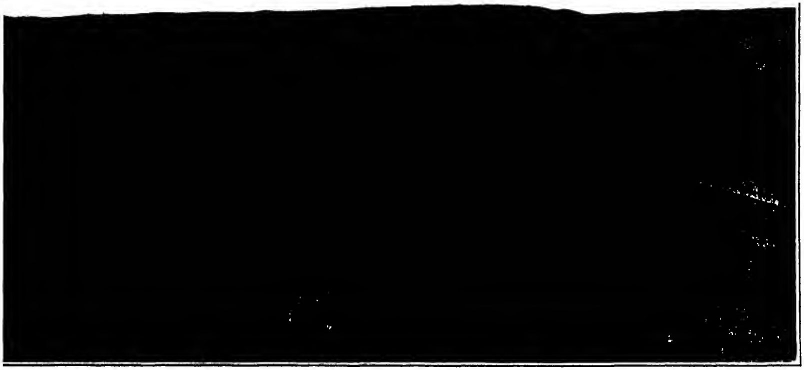
The work of attaching the new masonry to the sloping face of the dam had to be carried out during the periods when the sluices were shut, temporary embankments being improvised with bags of sand to keep the working area dry The work was done in separate sections, and as it was spread over five seasons, adequate time was offered before the new and old parts of the work were connected by the grouting. Owing to the careful arrangements made by the contractors in regard to labor, the programme, carefully prepared before the work was started, was carried out exactly as planned, and the new parts of the wall stood fully two years before the connecting bonding was taken in hand.

On the western side the barrage terminates in the structure forming the navigation lock. Formerly there were four lifts to meet requirements when the water was impounded, but in the new work a fifth lift had to be added. So far as the locks are concerned the walls of each have had to be raised, the extent of this increase varying from 18.4 feet in the case of the upper lock to 19.7 feet in the case of the fourth lock.

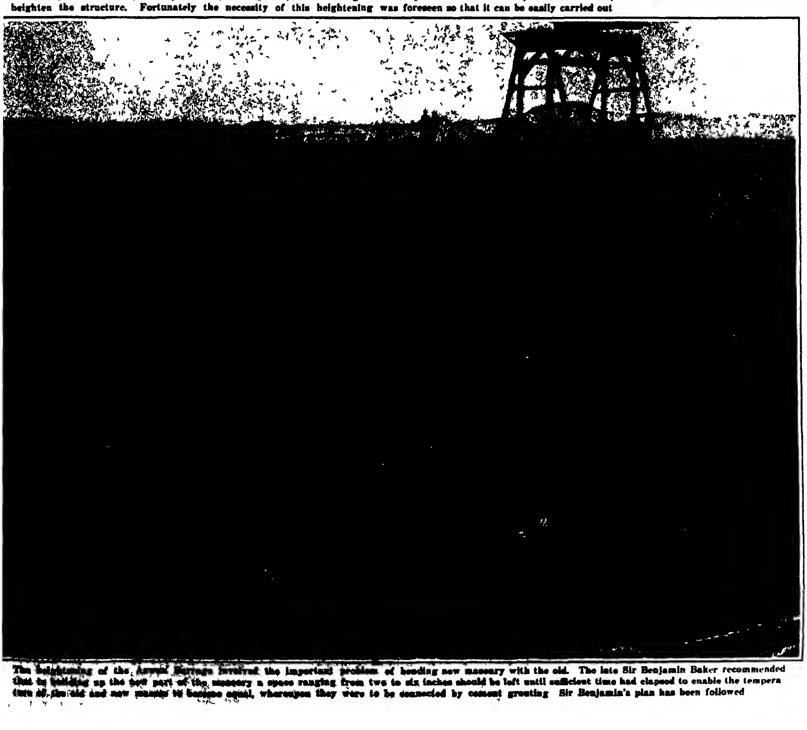
The alterations demanded extensive rearrangements in connection with the lock gates. These, as was pointed out in the SCIENTIFIC AMERICAN upon the opening of the original dam several years ago, are of a special single-leaf sliding type. Now, as the water level has been raised, the depth of water in the uppermost locks is very great, demanding gates 73¾ feet high, by 32 feet 2 inches wide, while the other gates are 59, 52½, 46 and 36 feet in height, respectively. Each is carried on a carriage which rolls over a roller path carried partly on a bascule and partly on the wall of the lock. On the land side a recess is provided in the wall in which the gate is carried when boats are passing through the lock.

In the alterations the gates were either moved bodily

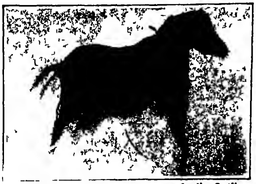
(Concluded on page 142)



When the Aswan Barrage was first projected Sir William Willcocks recommended that its height should be great enough to impound the water to a height of 380 feet above the sea level. The enormous volume of 88,300,000,000 cubic feet which should have thus been stored up seemed so vastly in excess of the actual requirements that, in response to public opinion, a lower height was adopted. The reduction proved a mistake, and now it has been decided to heighten the structure. Fortunately the necessity of this heightening was foreseen so that it can be easily carried out



The heightening of the Aswan Barrage involved the important problem of bonding new masonry with the old. The late Sir Benjamin Baker recommended that in building up the new part of the masonry a space ranging from two to six inches should be left until sufficient time had elapsed to enable the temperature of the old and new masonry to become equal, whereupon they were to be connected by cement grouting Sir Benjamin's plan has been followed



Horse 1 60 meters from nose to root of tail. Outlines of a hind showing through more recent picture.

The Altamira Wall Paintings

Some Remarkable Specimens of Primitive Man's Art

Aurochs, or European bison, 1.50 meters from nose to root of tail.

THE originals of the eight animal drawings reproduced on this page are probably of greater interest as *documents of human history*, than anything that can be found in Egyptian tombs or pyramids. They are in fact, taken with the circumstantial evidence attaching to them our warrant for believing that artistic power was highly developed in Palaeolithic man Of the vigor and correctness of the drawings there can be no question for anyone who has what may be called the zoological eye In an article on 'Man of the Old Stone Age in *The American Museum Journal* Prof Henry F Osborn says of these paintings "The frescoed ceiling of Altamira is the finest expression of palaeolithic art Not even the faultless reproduction of Abbé Breuil can convey any idea of the impression produced by this wonderful chamber It ranks for palaeolithic times with the great gallery of Velásquez in the Prado of Madrid The date of these paintings has now been determined—roughly at least—as between two hundred and three hundred centuries ago, in days when European man lived in caves and ate the flesh of the aurochs, or European bison

Between that remote period and the day—about thirty years ago—when Don Marcelino Sautuola first had his attention called, by his little daughter to the figure of an aurochs on the wall of the Altamira cavern these works of art had probably been seen by no human eye They are only dimly visible by the scanty daylight which falls upon them Don Marcelino was busy digging for flint implements in the floor of the cavern and unearthing bones which might tell him what the prehistoric tenants of the cave were in the habit of eating, when his little daughter, pointing at the wall suddenly exclaimed, 'Toro' Then by the light of candles, they began the investigation of these pictures which have since become famous, more particularly through the great monograph (*La Caverne d'Altamira*) published by M Emile Cartailhac and the Abbé Henri Breuil

But fame did not come to the Altamira cavern immediately after Don Marcelino's discovery After an examination by M Harlé, it seemed that the thinness of the crust of lime which coated the pictures indicated a comparatively recent origin, and their true palaeontological significance might have been lost had it not been for other wall paintings found in other caves, which carried with them—in the fact that the subjects included palaeolithic animals, such as mammoths evidence of extreme antiquity Altamira is in the neighborhood of Santillana, in the Asturian province of Santander which lies to the south and west of the Pyrenees. North and east of the same range investigations at several other places brought to light other drawings of animals, notably those of La Mouthe (1895) and *Combarelles* (1901) The increased interest in prehistoric cave pictures, leading to comparison of all these discoveries, and study of the remains found on the smoke-blackened hearths ended in the conclusion that Altamira as well as its French counterparts was indeed a palaeolithic dwelling

One of the first difficulties in the way of accounting for these paintings was the absence of daylight upon the surfaces which they adorn Palaeolithic man, presumably could not paint in the dark, or even in a twilight, any more than modern man But modern

Bellowing aurochs painted over unfinished sketch of one charging

Boar, 1 45 meters long from snout to tail. The artist began his sketch with one pose and finished with another

Galloping boar, 1 60 meters from root of tail to snout.

man—Don Marcelino Sautuola and those who followed him—needed good modern candles to obtain a good view of the pictures, and they had some difficulty in keeping the smoke of their candles from blackening the painted walls, just as the smoke of palaeolithic kitchen fires had left its mark to endure for more than twenty thousand years. It was only after a study of the remains of utensils found in the caverns that the *savants* solved this difficulty by the hypothesis that the prehistoric artists used lamps consuming animal oils, somewhat analogous to the blubber lamps of the Eskimo. Such lamps would give a very clear light, with hardly any smoke There remains the question Why should the primitive *artists* have chosen to decorate the darker recesses of their dwellings, rather than practise their art where the light of the sun would have helped them?

The answer to this question is connected with certain features in the wall paintings which at first were in themselves much in need of explanation In the first place, the various figures are not arranged in the form of friezes, or in any other way which would indicate that their intention was decorative they are placed here and there without any apparent artistic design whatever, though some of them are so drawn as to utilize accidental unevennesses of surface, giving something like an effect of colored reliefs. Then again, the figures are sometimes surrounded by lines of conventional indications which have been interpreted as representing little primitive houses. Putting all these circumstances together It seems probable that the paintings were made not for the love of beauty, or to 'show the hand' of palaeolithic Giottos, but with strictly business aims. They were, in fact, primitive pot boilers, done to supply the larder with material In none of the caves is there a picture of any animal that was not eatable, and—by the evidence of the bones found on the hearth—actually eaten by the cave-dwellers. The same, it appears, is true of the animal pictures made by Australian aborigines. The hypothesis of M Salamon Reinach is that, like the Australian aborigine, the palaeolithic man of Southern Gaul and Northern Spain believed in his own paintings of deer, boars, aurochs, horses (considered good eating) and mammoths as potent to attract the animals themselves. The pictures were supposed to operate as charms on the very big game which they represented, so that these creatures found themselves instinctively wandering into the vicinity of the cavern adorned with their effigies, and the farther in the pictures were, the more secure would be the capture of the subjects.

As to the primitive apparatus with which these paintings were achieved, the learned investigators have reached some important conclusions. Whatever may have been the material of the pigments, it was ground in stone mortars with stone pestles. The pigments were laid on with animal fats, instead of oils, from a palette consisting of the scapula of some animal For brushes, it is supposed that these primitive painters used the feathers of birds or sticks chewed at the ends.

Three animals an ox (finished), a horse and a boar (sketched). 2.25 meters between the extreme muzzles.

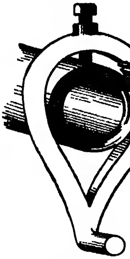
Hind, 2.20 meters long Evenness of the outlines indicate a smooth wall surface. Small aurochs to the right.

Aurochs, 1.50 meters from forehead to hind quarters. Outline formed partly by irregularities of the surface.

Notched Lathe Dog

By William Gritzinger

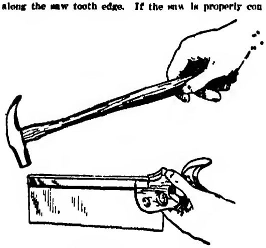
AN ordinary lathe dog can easily be prevented from letting its work slip and causing trouble. The following method will prove good. Take a three-cornered file and file several deep notches into its inner face at one side. Now put the work and dog in place as illustrated, and the dog will grip it with astonishing firmness. Work as large as the dog will admit can now be turned without slipping.



Non-slipping lathe dog

Straightening a Back Saw

AFTER the back saw has been set and filed quite a number of times it will become slack and kinky along the saw tooth edge. If the saw is properly constructed one tap of the hammer on the back at the extreme end, will straighten it instantly.—A. B.

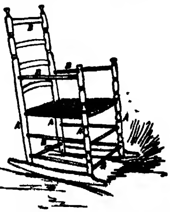


Straightening a back saw

Chair Making One Hundred Years Ago

By Albert F Bishop

QUITE frequently in occupying a very old chair it will sway from side to side quite easily, but still the parts will not separate. This is due to the construction, which is quite ingenious. The wood in shrinking grips tightly on the rounds. The uprights or legs marked *A* are of green wood. The rounds and curved back connections marked *B* are thoroughly seasoned. You can readily see that when the green wood becomes seasoned it will shrink very tightly on the seasoned pieces, so much so that they very seldom come apart, although there is no glue used.

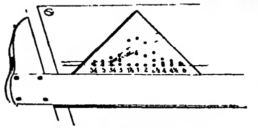


Chair construction of our great-grandfathers.

Lettering Triangle

To the Editor of the WORKSHOP DEPARTMENT:

Referring to the different suggestions for making the guide lines for lettering drawings that have appeared from time to time in your columns, I wish to call attention to a very neat device stationers are selling over here. It consists of a triangle made of celluloid and provided with vertical rows each of three flaring holes. Placing the point of a lead pencil into one of the holes of the row selected, the triangle is run along a ruler by means of the pencil point. Arrived at the end of the line thus drawn the pencil is placed into another hole of the row in question and a line drawn in the opposite direction. The operation is repeated once again and these lines will be found to be drawn exactly parallel and spaced correctly apart. The rows of holes are designated by the number of the round-writing pen best adapted for the size of letters in question.



Drawing guide lines for lettering

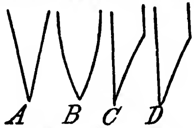
Bonn, Germany — ED. C MAGNUS.

Sharpening Edge Tools

By W D Graves

THE essential feature of a good cutting edge is that its two sides shall form a sharply defined acute angle which can only be attained by having such sides straight as shown, much magnified, at *A* in the drawing rather than curved as shown at *B*. Where the novice usually fails in whetting an edge tool is in giving it a rocking motion, producing the rounded edge and the principal element of skill in the operation lies in holding the blade and the stone at the same relative angle throughout. There are some apparent exceptions to this rule, as the common ax but they are only apparent, not real. An ax used for chopping is better ground with the sides smoothly curved but the sides of the extreme edge, if it is a good edge, must be straight. Of course these straight sides may be very short, only as long as they are made by the final setting," or whetting, of the edge, but they are there.

The proper "thickness" of the edge i e the degree of acuteness of the angle formed by the two sides depends wholly upon the nature of the tool and the work it is intended to perform. A 'thin' edge will of course, cut more easily but it will also break and become dulled more quickly, so the proper angle must be determined, by observation and experiment, for each tool and purpose. The conservative beginner will aim to err in the way of making the edge too thick, then as he finds it amply strong to do the work without breaking or nicking he will make it a little thinner and so proceed till he learns the most effective and economical angle. An edge which would be sufficiently enduring on soft pine would become almost immediately blunted on lignum vitae while, for use on any given wood, differently tempered tools require sharpening at different angles in order to give the best results.



Various forms of cutting edges.

As most wood-cutting tools are sharpened like a chisel this form of edge may perhaps best be used in illustrating the method of sharpening all. If the tool is very dull the work of sharpening is expedited by first grinding it on a stone or wheel of a grit too coarse to make the final cutting edge, taking care to have it symmetrical and either straight or of the curve of the grinding wheel, as shown at *C*. This method of making the sides inwardly curved—or 'hollow grinding'—which is carried to its extreme in razors, lessens the work of whetting, but tends to make the edge weak and incapable of withstanding hard usage.

On the grindstone or abrasive wheel the tool is brought to an edge somewhat more acute than is desired for the finished one; but, owing to the coarseness of the abrasive used, it is too rough for keen cutting. The final edge is "set" by rubbing with or on a flat finishing stone of finer grit, making a new and sharply defined bevel as shown, magnified, at *D*.

All cutting edges are somewhat serrated, some being finished on a stone so coarse that the serrations may be seen with the naked eye, as that of the common scythe. Such edges are made to cut by a sliding action, like a saw, and, for that matter, even a razor will cut much more readily if given a slight endwise motion.

Strap Hinges vs. T-Hinges

By G W D

IN deciding whether to use strap or T hinges one should keep in mind the fact that, when the two are of the same nominal size—as six inch or five-inch—and of about the same cost, the T hinge is about twice as strong as the other. A thing is only as strong as its weakest part, and the weakest part of such hinges is the joint or that part of the flap which bends around the pivot. Both strap and T hinges usually fail through the straightening out or breaking of this part and, as will be seen by reference to the accompanying sketch this part is twice as wide in the *T form* as in the strap. In the T hinge it is of the whole width of the strap as at *A B* while in the strap hinge it can be of only half that width, as *C D*.

Fig 1.—Strap hinge

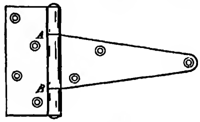
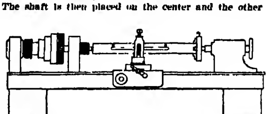


Fig 2.—T hinge

Cutting Keyways With a Lathe

By H D Chapman

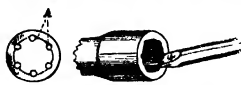
A METHOD of cutting keyways with a lathe is pictured in the accompanying drawing. A plug center is made to screw in the lathe chuck as shown at *A*. The center is then placed in the tail stock of the lathe. The shaft is then placed on the center and the other end in the chuck thus holding the shaft rigid while the keyseat is being cut. A hole is drilled at either end of the keyseat *BB*. This gives the tool clearance while it is being machined. The lathe is geared up to a high pitch the tool is set in the tool post the lathe is started up, and the feed is then thrown in thus feeding the carriage along the work. Of course a special tool is required to suit the keyseat. A keyseat can be cut in a lathe just as well as it could be in a shaper.



Cutting keyways with a lathe.

Making a Socket Wrench

MOST mechanics will not take the trouble to cut out a socket wrench but this is easy enough when done according to the drawing. It is laid out on the steel for drilling. Six small holes should be drilled if the socket is to be a hexagon. These holes will cut out the corners. Then one large hole is drilled in the center which will cut out nearly all the stock and should cut two thirds of its way into the small holes. Then there is but little chipping to be done after this operation, simply two small fragments, which are indicated at *A*.



Method of cutting out a socket wrench

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Recent Improvements in Machine Tools—I

[IT has often been said and rightly so, that the perfection to which metal working has attained is one of the miracles of modern times. In many factories throughout the country the various pieces are turned, milled, sawed, planed, or ground in such quantities at such speeds and with such unfailing accuracy as to command the admiration of the observer. Yet in spite of this perfection there always seems to be room for further improvement. This is the first of a series of brief articles on recent improvements that have been made in machine tools.—EDITOR.]

AMONG the inventors who have recently added valuable changes to the highly developed art of machine tool manufacturers are F. L. Eberhardt and W. F. Zimmermann of Newark, N. J.

The device patented by these inventors is a machine for cutting the teeth of helical gear wheels, without imparting a differential motion either to the blank to be cut or to the cutter.

The advantage of this invention lies in the fact that a single direct connection is established between the rotation of the cutter and blank spindle, an advantage which is an essential feature in all generating mechanisms. A more perfect control of the feeding mechanism, both of the cutter and of the blank itself as well as of the relative ratios of rotation of the cutter and blank, is thus effected.

In the figures, the work table 3, adjustably mounted upon the frame 1, is provided with a revoluble work spindle 4 in which the work arbor 5 is secured, whereby the gear blank 8 is centered and secured in the spindle 4. A worm wheel 7 is fastened in the lower end of the work spindle 4 and rotated by the worm 8 in engagement therewith. This worm is mounted in the bearings 9 of the work slide 3, and is provided with a gear 10 which meshes with a gear 11 slidably keyed to the index shaft 12.

The index shaft 12 mounted in bearings at either end of the frame 1, is connected to the index driving shaft 13 by means of a compound train of change wheels 14, 15, 18, and 19 to drive the feed of the helical cutter 31. The stud 16, carrying the gears 15 and 18, is slidably arranged in the arm 17 to accommodate change gears of different diameters. This arm 17 is pivotally mounted upon the driving shaft 13, and is secured in the various positions by the bolts 22 to the bearing 21.

The drive shaft 13, which imparts motion directly to the gear blank receives its motion from the main shaft 25 (Figs. 2 and 3) rotated by the cone pulley 28 through the worm wheel 26 and the worm 27. The ratio of the worm wheel 26 and worm 27 must be equal to or a factor of the ratio between the main driving shaft 25 and the helical cutter so that for each rotation of the cutter the index drive shaft will make a complete rotation or a multiple thereof.

The helical cutter 31 is secured to the cutter shaft 32, mounted to rotate in the swivel carriage 33. The cutter carriage 34 upon which the swivel carriage 33 is mounted is vertically adjustable upon the stanchion 2 and is parallel to the axis of the gear blank. The swivel carriage 33 is secured to the cutter carriage 34 in any angular position in relation to the gear blank by bolts 35 in the T slot 36.

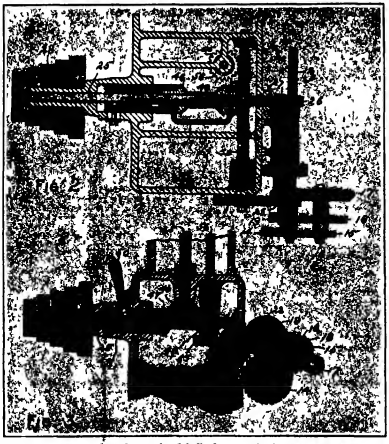
The helical cutter is pivoted about the shaft 12 by means of the bolts 35 and T slot 36, and a rotatable connection through the driving gear 37, pinion 38, shaft 39, bevel gears 40, 41, 43 and 44 is thus secured with the cutter drive shaft 45 for any angular position of the cutter.

For reversing the direction of rotation of the helical cutter, the bevel gears 47 and 48 on the drive shaft 25 are operated by the yoke 49 and handle 50 to engage, alternately the bevel gear 46 on the cutter drive shaft 45.

The feed of the cutter parallel to the axis of the gear blank is obtained through the change gears 23 and 24, feed worm gears are selected in accordance with the material of the blank and the angle of the helices and placed in position. The proper index change gears are next placed between the index driving and index shafts. The work blank is then adjusted by the screw 58 and the hand wheel 59 for the proper depth to be cut.

The teeth of the gear will then be cut

A single direct connection is established between the rotation of the cutter and blank spindle, an advantage which is an essential feature in all generating mechanisms.



A machine for cutting the teeth of helical gear wheels without imparting a differential motion either to the blank to be cut or to the cutter.

shaft 53, feed worm 54 and wheel 55, from the index driving shaft 13, which rotates in synchronism with the helical cutter. The feed screw 56 engages a threaded portion 57 of the cutter carriage 34 and is rotated by the feed worm wheel 55.

To arrange the apparatus to cut helical gear wheels with a helical cutter, the gear blank is mounted upon and secured to the work spindle, the cutter is secured to the cutter spindle, and the swivel carriage is adjusted to the proper angle with relation to the gear and according to the angle of helices to be cut, and is secured in such position by bolts. The change feed by one passage of the cutter across the face of the blank.

(To be continued.)

Prizes Offered by German Engineering Societies

THE Verein Deutscher Maschinen-Ingenieure offers a number of prizes, as follows:

I. A prize of 1,500 Marks for an investigation of the causes and means of prevention of street noises due to railways and street railways.

II. A prize of 1,500 Marks for a thesis on modern systems of steam heating for railway carriages.

III. A prize of 1,500 Marks for a thesis on modern lifting devices in use in locomotive works.

IV. A prize ranging up to 4,000 Marks for the design and computation of springs for railway carriages.

Readers interested in these competitions are advised to address further inquiries regarding details and conditions to Die Geschäfts stelle des Vereins Deutscher Maschinen-Ingenieure, Lindenstrasse 80, Berlin, S. W.

COMPETITION FOR MINER'S ELECTRIC SAFETY LAMPS.

According to *Electrical Engineering*, a prize of $6,250 for the best electric lamp provided with a reliable fire-damp indicator is being offered for competition in Germany by the Verein für die Bergbaulichen Dortmund. The lamp is to be capable of giving a light of one Hefner candlepower after burning for 12 hours, must be safe in the presence of fire-damp even if damaged. Three lamps with descriptions (in German), drawings, etc., in triplicate, must be submitted to the Verein, at Essen-Ruhr, before October 1st, 1913. The judges will be a committee representing the Government, the Westphalian Miner's Association, and the Dortmund Mine Owners' Association.

Automatic Fog Gun

By E. O. Carter

AN automatic *fog gun* is now being put to active service on the Clyde. The invention consists of a method of obtaining powerful explosions of a mixture of acetylene and air at regular predetermined intervals. The machine is at present made in two sizes, the cost of working being, respectively, about 4 cents and 6 cents per hour.

The writer when in Glasgow recently had the pleasure of hearing the smaller machine at work, and the noise of the explosions was sufficient to take away any desire to hear the larger machine! A powerful acetylene fog gun has already been erected on a rock station off the west coast of Scotland, where it has proved itself much superior to the sonite signals usually placed in such situations, as it is not liable to be exploded prematurely and is not open to the danger of being fired by lightning. Furthermore, it does not require the constant supervision of a keeper to put on charges and fire them, as it is entirely automatic. Once started it will continue until stopped. Where the apparatus is fixed on an isolated rock, and in other situations where a wire connection is inadvisable, it is intended to arrange that it shall be started and stopped from shore by means of a small wireless installation.

The invention is thus admirably adapted for use on buoys and where expense and want of space on which to build prohibit the use of compressed air fog signals.

The present machine is the outcome of years of experiment covering a variety of gases, the mixture of acetylene and air having been found to give the best results.

The Death of James B. Hammond.—James Bartlett Hammond, inventor of the typewriter that bears his name, died at St. Augustine, Fla., on January 27th. He had a varied career. Originally intended for the ministry, he graduated from the University of Vermont, and eventually entered the Union Theological Seminary. He soon gave up the idea of joining the church, and went to Germany, where he studied philosophy. He was a war correspondent during the Civil War. As a shorthand reporter in a Boston court, he first conceived the idea of his typewriter. To this he devoted the rest of his active career. He made a large fortune out of his invention.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Of Interest to Farmers.

DEVICE FOR HOLDING TEETH IN AGRICULTURAL IMPLEMENTS.—M L. AKERS, Pendleton Ore The invention is particularly adapted for holding the teeth of drag harrows against their supporting bars. It provides means for adjusting the teeth quickly perpendicularly to the frame bar of the harrow or at an angle laterally to the line of draft.

DEVICE FOR EXTERMINATING VERMIN ON HOGS.—A W APPLEGATE, Brawley Cal In order to exterminate vermin on hogs Mr Applegate provides an apparatus which may be set up within an opening in a fence or other inclosure through which the animals pass and thereby actuate an oiling device. Means are provided for preventing waste of the oil, and applying to the backs of the animals only so much as is necessary to exterminate the vermin.

STUMP PULLER.—J M PHILBROOK Beach, Wash. The invention is directed to an improved construction of stump-puller adapted to be operated by a draft animal the construction and arrangement being such that the drum on which the rope is wound to pull up the stump is adjustably connected to the sweep arm, so that these arms and the drum are in turning relations with each other only when the sweeps are moving

DRINKING FOUNTAIN FOR POULTRY.—G W GIBBONS, Hadley Ill. The principal objects of this invention are to provide means for preventing chicks or other poultry from fouling or otherwise disturbing the drinking water, to prevent the budding or crowding of poultry about the fountain and to provide a simple compact structure that may readily be transported.

Of General Interest.

COUNTER.—J G BIGGAR, Lincolnmville, S. I., N Y Mr Biggar's counter has a plurality of sections, each having ten parallel ruled lines with holes, in the neighborhood of which are printed the digits and a naught, the sections reading from the right to the left, units, tens, hundreds, etc, so that when a pen is inserted in the 5 hole in the units section, in the 6 hole in the tens section, in the 4 hole in the hundreds section and in the 8 in the thousands section, the sum indicated will read 8,465.

CARD HOLDER.—J A MANSON, 347 W 87th St. New York, N Y The invention relates to a holder for sales cards, which may be readily mounted and which will positively retain the cards in removable position. It consists of a light metal sheet the outer edges of which are turned inward on both sides of the sheet to hold cards upon opposite sides of the same the sheets being mounted upon a suitable support.

PROCESS FOR REMOVING COPPER FROM OTHER METALS.—R R MORENO, care of Bethlehem Steel Works, Allentown Pa Before they are accepted guns must be subjected to proof firing tests with charges of progressively increasing size In these tests copper bands of the projectiles are scraped by the compression slopes and rifle parts until they become fouled with a coating of copper This invention provides for dissolving the copper by an ammoniacal solution in the presence of air

Machines and Mechanical Devices.

SEPARATOR.—C FREDRICKSON, Lock Box 113, Rice Lake Wis. The object of this machine is to separate potatoes into various sizes or grades and at the same time to clean them Means are provided for transporting the potatoes without injury to a separating screen, and dumping or forcing them on the screen while the screen is in operation so that the potatoes will move in a continuous stream

WASHING MACHINE.—J W PIPPIN, Brownwood, Tex. This machine consists of a boiler with a receptacle for clothes therein the receptacle having a perforated bottom and sidewalls. The boiler is placed in a furnace which heats the water in the boiler, converting it into steam and forcing it into the receptacle through the clothes. A disk valve prevents the steam and water from entering through the perforated bottom When the steam is cooled and condensed by passing through the clothes the disk valve drops open permitting the water to return to the lower portion of the boiler

POWDERED COCOA FLUFFER, MIXER, AND COOLER.—P G HOLLSTEIN, care of J M Lehman Co., 13 Laight St., New York, N Y The machine consists of a number of superimposed pans in each of which are revolving arms, acting in succession on the cocoa to cool, stir up, fluff mix and knead the cocoa particles after which they are forced through openings in the bottom of one pan to the next, where the same operation is repeated, and so on through the pan series.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Architecture on Panama Canal

(Concluded from page 101.)

that it strikes us as an architectural hybrid. The slender supporting pillars, carrying a square, shallow platform, from the center of which rises abruptly the massive bulk of the tower, present a combination which, from an architectural point of view, is, to say the least, extremely inharmonious and unbalanced.

This range tower would be an eyesore at any point along the Canal, but standing, as it does, in a particularly prominent position, where it will immediately catch the eye of everyone who makes the transit of the locks, whether they approach them from the Atlantic or from Gatun Lake it will serve to belittle the monumental Gatun locks.

The SCIENTIFIC AMERICAN has always urged the necessity for the collaboration of the architect and the engineer in all cases where there is an opportunity to give architectural expression to engineering construction, and we have never seen a case where the call for such collaboration was so strong as here. The Editor of this journal is no architect, but he has ventured to present the accompanying sketch as showing that the engineering requirements of this problem might have been met in a manner more pleasing to the eye and more consistent with the dignity of the Panama Canal structures.

The cost of reconstructing this particular tower, or at least the lower half of it, would be relatively trivial. We commend the question to the attention of the Isthmian Canal Commission.

Voice-operated Typewriter.

(Concluded from page 106.)

speech will be faithfully recorded in type. However, there are serious limitations which must be considered. In referring to the work of the human typist, we took an example in which no complicated exercise of mental faculties was required, merely a simple word phonetically spelt. Surely in the making up of sentences, starting a sentence with a capital, punctuating it properly, and spelling the words according to the dictionary, a great deal of reasoning power is necessary. What can the machine do in such a case?

The inventor proposes a special form of electric typewriter in which unlimited speed can be obtained by arranging the type bars in a full circle and placing the paper on a vertical cylinder, revolving at constant speed. Then on account of stops between words, a space equal to the width of one or more letters would be automatically produced between the words. Instead of using capitals and small letters, it would be preferable to use nothing but capitals. However, if it were essential to have both capital and small letters, then at the beginning of a sentence a certain little-used sound might be uttered which would operate the shift key of the typewriter so as to produce a capital. The same means could be adopted for operating the period and comma keys. But the principal drawback of the system is that the writing would be phonetic. How can the machine distinguish between "to" and "too" and "two"? Obviously it cannot compete with the human typist, particularly in the English language, as long as we stick to our abominably complicated spelling, unless the dictator comes to the rescue, by pronouncing the words as they are spelled. This would be quite a task with some words, such as "phthisic" or even so simple a word as "laugh."

However, the inventor makes no undue claims for his machine. It is his idea that it might be used as a dictation machine in place of a phonograph. In this connection it offers many advantages, principally because the dictator is able to see just what he has written, and can make corrections and refer back to statements he has already made without laboriously hunting over a cylinder, as is now necessary with the common dictation machine. The phonetic unpunctuated draft made in this way could then be transcribed by a typist. It is quite possible that if the machine were [illegible]

commercial service, it would do much toward the cause of simplified spelling. The man who is accustomed to seeing his letters and other writings typed phonetically would soon learn the advantages of this form of spelling and would be liable to adopt it.

Another possibility of the machine is that it could be connected to a telephone to take down telephone messages automatically and print them on the electrical typewriter. It has also been suggested that the machine could be used to advantage in schools for deaf mutes as it would afford the pupils a means of determining visually the character of the sounds they are uttering in learning to speak.

However, the inventor is not over sanguine of the commercial development of his invention. The apparatus must necessarily be very sensitive. The resonant tones of certain letters are so close that a very careful tuning is necessary and the dictator must learn to talk in a monotone after the machine has been tuned to the fundamental pitch of his voice. Mr. Flowers does not present his invention as a complete solution of the problem of the voice operated typewriter, but merely as a step toward that end which may lead to further development on his own part or on that of other inventors.

Enlargement of the Aswan Dam

(Concluded from page 1.)

from their present position to be set in the succeeding step or where cut down to meet the new situation, while new gates were required for the original No. 1 lock owing to the height of the water being increased.

The thickness of the masonry dam as now completed is increased at the top from 23 to 36 feet and it carries a roadway 29½ feet instead of 18.4 feet wide. The roadway is provided with a track along which moves an eight-wheeled 100-ton crane of 25 tons capacity.

Doubtless the raising of the flood level behind the barrage will be regarded with misgivings by those interested in Egyptian archæology. It was respect for this agitation which induced the government to reduce the height of the first drawings for the dam. Still it must not be forgotten that the very existence of the Soudan depends upon the supply of water for the crops, and accordingly antiquarian must give way to a certain degree to utilitarian interests. The Egyptian government during the past five years, while the alterations to the barrage were in progress, devoted $500,000 to the preservation of all archæological relics within the flooded area. This work was intrusted to Mr. Weigall, inspector for Upper Egypt of the Department of Antiquities, and he has carried out his work in a thorough manner. While a certain number of the ancient buildings now are lost forever and others are periodically submerged, all the most important ruins are secured. Their foundations, which were decrepit, have been strengthened, and a certain amount of judicious restoration has been made in the case of the more dilapidated buildings. All the inscriptions below the high water mark of the impounded water have been carefully copied for preservation, although some of the colored frescoes must unavoidably be damaged by the periodical submergence. True, some of the buildings will be less accessible now than formerly, but the student of Egyptian antiquities need only to select a suitable season for his visit, when he will be able to wander among the ruins with even greater facility than formerly.

The raising of the dam and the water level virtually completes the irrigation scheme which was elaborated by the engineers and advisers to Lord Cromer's government, although a comprehensive improvement and development scheme in the Delta is in progress. Although the project was severely criticised at the time of its inauguration, subsequent events have proved that the irrigation projects represent the greatest benefits that have been bestowed upon Egypt since its occupation by the British, while financially the scheme is proving a complete success.

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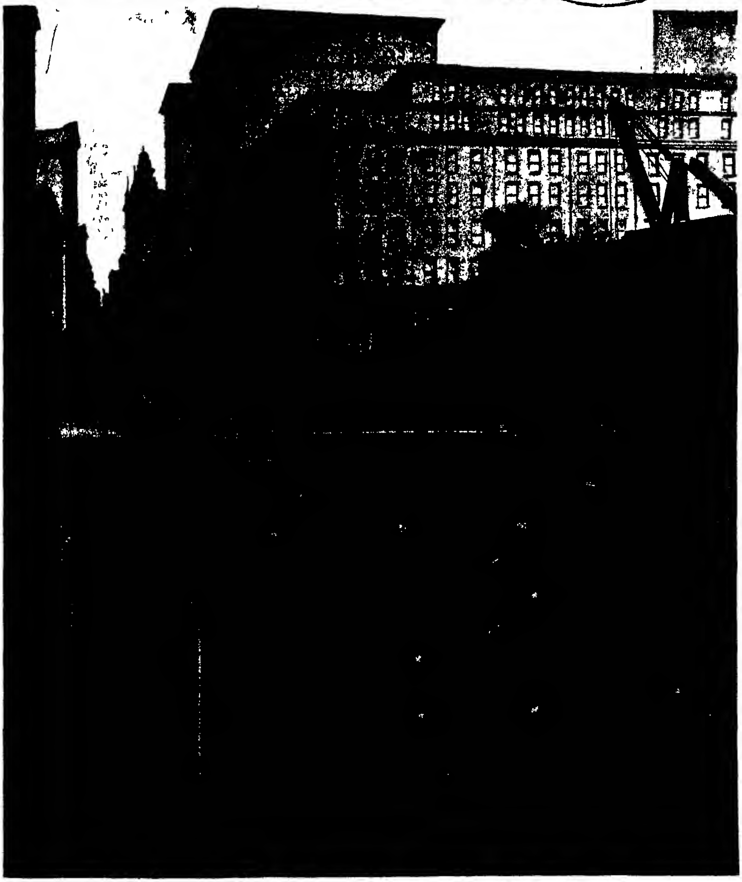

This sectional view, taken at the new City Hall station, shows the construction of the subways by the cut and-cover method by which the material is excavated without any disturbance of the surface of the streets and sidewalks.

BUILDING THE FOUR-TRACK SUBWAY BENEATH BROADWAY, NEW YORK.—[See page 154]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are *sharp* the articles *short* and the facts *authentic* the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement

A Foolish Measure

IT is simply amazing to learn that a bill has been introduced into the House of Representatives seeking for Government aid in the preliminary work of building a dam or jetty, from 250 to 500 feet in depth and 200 miles long, reaching out into the broad Atlantic from the coast of Newfoundland Of all the foolish bills that have found their way into the halls of Congress, surely this is the most conspicuous. It is the evident purpose of the promotor of this most modest proposal to divert the Gulf Stream, and thereby bring about sweeping climatic changes in the United States in Greenland and over various widely scattered areas of the habitable and uninhabitable globe

We have been asked to comment on this bill, and we do so

The SCIENTIFIC AMERICAN expresses the hope that in the consideration of the scheme, the gift of imagination will be so mercifully tempered by the saving grace of humor, that the measure will be given an early burial, with such obsequies as, in the opinion of the House are becoming to its dignity and importance

New York Pier Problem Settled

IN a characteristically clear and forceful decision, Secretary of War Stimson has effected a compromise between the interests of the Port of New York and the interests of the nation at large which must be considered as a very satisfactory solution of a pressing problem The city of New York had asked permission of the War Department to locate its new pierhead line so that it would run in a direct line from Thirtieth Street to Pier No. 1 at the Battery This would have involved a considerable lengthening of the new Chelsea piers which are located at the narrowest part of the river The War Department took the position and indeed has held it for several years, that no further encroachment upon the fairway at its narrowest point could be allowed Under Secretary Stimson's decision the pierhead line at Chelsea is to remain where it is but the city is permitted to straighten its pierhead line between Gansevoort Street and Pier No 1 This will make it possible to build a dozen or fifteen piers of a length of one thousand feet – sufficient to provide for the growth of ocean steamships for many years to come. Also the Secretary has given permission to straighten out the pierhead line on the New Jersey side of the river between the Morris Canal Basin and the foot of Fifth Street Hoboken a section lying south of the Chelsea reach. This will give similar and even more generous accommodation for the future growth of steamships of the German companies.

As to the more remote future the Secretary refers to the plan of the Board of Estimate and Apportionment which contemplates the construction of long piers between Forty fourth and Fifty sixth streets within the existing pierhead lines. This plan is designed to secure the desired length by excavating back into Manhattan The construction of such piers will be costly and in view of the constantly increasing value of land we would suggest that it would be good policy for the city to purchase at once all the land lying between these streets and extending back as far as Eleventh Avenue This would provide sufficient depth from the pierhead line for piers of a length up to 1,500 feet and it would also accommodate the marginal terminal railway contemplated by the present Dock Commissioner

The Problem of the Mississippi River

THE great flood of the Mississippi River of last year—the largest in recorded history—when the levees were over topped or carried away bodily, and vast areas of the valley were inundated, has created a doubt in the minds of the public as to whether the method of control by revetment and construction of levees was not a failure. This doubt has been freely expressed in the many letters which have been published during the past year in the columns of the SCIENTIFIC AMERICAN We have made no comment upon these letters, many of which suggested alternative and supposedly better plans for the control of the river, and our silence has been due to the fact that we were making a study of the problem from every possible source of information with a view to determining for ourselves whether the present plans for the control of the river or some other were the best to apply in grappling with and controlling this stupendous problem

We have come to the conclusion that the present plan of the army engineers of protecting the banks of the river by revetment and raising the banks by artificial levees to a sufficient height to prevent overflow is not only the best way to control the river, but the only way

If it be asked whether the disastrous inundation of last year does not spell failure, we answer emphatically No The inundation occurred, not because the plan was faulty but because it was incomplete. It was also due to the fact that the existing levees were built only to a sufficient elevation to control the highest flood on record, which the flood of last year greatly exceeded —the maximum flow reaching the enormous total of 2,300,000 feet per second, or twelve times the amount of water that passes over Niagara Falls.

The trouble with the Mississippi work is not that the plans are wrong but that they have been carried out piecemeal and in a somewhat happy go-lucky manner The nation should apply to this great work the lesson which it has learned at Panama A new grade line for the summit of the levees should be established, said line being well above the height reached by the flood of last year, a liberal estimate should be made of the total cost of building these levees, and of protecting the adjacent banks of the river throughout the whole length of the levees with revetments an estimate should be made of the largest annual appropriation of money that could be efficiently expended by the largest force that could be concentrated upon the work, and finally the execution of the work should be placed entirely in the hands of the army engineers with a Col Goethals in supreme and unhampered control

Such an estimate of the total cost of a completely leveed and revetted Mississippi River has been made by the army engineers under the Mississippi River Commission. The total expenditure would be about seventy million dollars for the levee work and about ninety million dollars for the revetment.

Is complete control of the Mississippi River and the absolute prevention of disastrous floods worth the expenditure of one hundred and sixty million dollars? The SCIENTIFIC AMERICAN is decidedly of the opinion that the money would be well spent In the first place, the completion of this work would afford protection to 29,000 square miles of land. The increased value of the land, due to protection is shown by a statement of Col Townsend president of the Mississippi River Commission who has recently testified before the Committee on Rivers and Harbors in the House of Representatives that twenty years ago when he was first stationed in the St Francis Basin land in that vicinity could be bought for a dollar or two an acre, whereas to-day it is worth anywhere from twenty to fifty dollars and even one hundred dollars an acre. Furthermore, there is the humanitarian consideration that this work would prevent the great loss of life and destruction of property which occurs when the river breaks loose. And finally there is the consideration that the completion of this task will constitute a great national work of engineering comparable, in its magnitude and beneficent results, with the execution of the Panama Canal

We will now proceed to discuss the criticisms of the present plan, and the suggestions of alternative schemes of control, which have been made in the many letters referred to above. It has been stated that the whole principle of levee building is wrong, and this for the reason that the matter brought down in suspension is deposited along the bed of the river, which is continually being raised, that this necessitates a raising of the levees which must go on indefinitely As a matter of fact, what takes place is this when the floods come down, the deep pools are scoured out and the material is deposited on the shoals farther down the river, causing a temporary raising of the bottom at these points. As the river falls, the action is reversed, the bars are scoured out and the sand is deposited in the next pool. Careful surveys for several decades show that not only has there been no raising of the river bed, but the cross-section of the river has slightly increased.

As to the proposal to control the Mississippi by building vast reservoirs near the head waters of the river and its tributaries, it may be said at once that the magnitude and cost of such reservoirs and the enormous areas of land that would have to be condemned, render such a scheme impracticable. Its advocates have failed to realize the stupendous magnitude of a problem which involves the control of flood waters that sweep down the Mississippi River at the rate of 2,300,000,000 cubic feet *per second* Testifying on the point, Col. Townsend said before the House Committee "If you were to destroy the whole State of Minnesota, that is, stop every bit of water flowing over it, it would not have made a difference of three tenths of a foot in the height of the last flood at Cairo" Again, if, as has been suggested, the St Francis Basin were converted into a storage reservoir, and the floods were thereby reduced three or four feet in height, it would be necessary to sacrifice no less than seven thousand square miles of country, or the area of a good sized State

Another favorite scheme contemplates the diversion of the Mississippi or of a large portion of its flood waters, by means of sub-channels, or "canals," excavated on one side or the other of the river This suggestion also fails to appreciate the magnitude of the problem If such channels were to be cut, they would have to be leveed in exactly the same way as the river which they were intended to relieve To produce any serious diminution in the height of a river that was passing down 2,300 000,000 cubic feet of water per second, it would be necessary to divert from 400,000 to 600,000 feet per second, which means that an artificial river would have to be excavated and leveed whose flow would be from two to three times as great as the whole flow of the Niagara River

The proposition to straighten out the river by cutting through the bends is impracticable for the reason that while the more rapid flow would relieve the flood, in the districts thus affected, this relief would be obtained at the expense of the districts lower down the river The swifter current of the flood water due to the shorter course, would necessitate a corresponding increase in the height of the levees in the lower sections of the valley

As to the important question of financing the work the simplest and most effective plan of course, would be to do with regard to the Mississippi as we have done at Panama make it a national problem and provide the whole cost from the national treasury. Hitherto the Government has put up so much money, so much has been contributed by the local levee boards, and in one case, at least, the State has made appropriations. It is not surprising to learn that Col Townsend designates such conditions as amounting to practically "an absence of system." Says he "We have just simply been waiting each one doing the best he could—the levee boards have been doing their work and the district engineers have been doing whatever they could with their funds, and it has been a happy-go-lucky method of business."

We believe that the most satisfactory way of financing the project would be for Congress to treat the improvement of America's greatest river as a national undertaking make the necessary appropriations abolish the system of individual boards and place the execution of the work under the one-man control of the army Next to this the best plan would be one of joint Federal and State appropriations, in proportions to be determined by the local advantages secured with the physical design and execution of the work intrusted to the Corps of Engineers of the Army, working under the absolute control of a army officer of proved executive ability

In another year the Panama Canal will be completed Why not move Col. Goethals with his admirable staff and perfectly working system from the Isthmus of Panama to the Mississippi Valley?

Meteorology in the Far East

AT the suggestion of Prof. Nakamura, in charge of the meteorological service of Japan, there will soon be held a meeting of the directors of meteorological observatories in the Far East—the first assembly of its kind. Practical meteorology has made great progress in that part of the world in recent years. Notable steps have been the extension of the Philippine Weather Bureau to outlying islands favorably situated for keeping track of typhoons, the organization of a complete meteorological service in Indo-China, the establishment of a telegraphic weather service along the whole China coast, and to a rapidly growing extent in the interior of China, under the Zikawei Observatory, at Shanghai, the creation by the Germans of a local service for Kiao-chau, with headquarters at Tsingtao, and the organization of an excellent service in Korea, under Japanese auspices. It is understood that China intends to establish a national weather service, with headquarters at Peking, but no details of this plan are yet known.

Engineering

Battleship Costs and the Eight-hour Law.—The Chief of the Bureau of Construction and Repair, Rear-Admiral R. A. Watt, states in his report that the average price per ton of normal displacement of the "Texas" "Nevada," and "Oklahoma," which are being built under contract under the eight-hour law, is $215.26. The average price of the three preceding battleships, built by contract when the hours of labor were unrestricted, was $177.05 per ton of normal displacement, and for the five preceding vessels it was $180.99 per ton.

Prosperity in British Shipbuilding.—Just now the British shipbuilding yards are experiencing an extraordinary run of prosperity. The total tonnage of all ships under construction for merchant and navy service reaches the huge total of 2,466,940 tons, of which about 500,000 tons consists of warships for the British and other navies. In 1909, a period of depression 764,520 tons of merchant ships was built, or rather was under construction. To-day there is under construction 1,970,065 tons of merchant ships.

To Dock the Largest Liners.—The city of Boston is to be congratulated on its enterprise in appropriating $3,000,000 for the construction of a drydock capable of taking the largest ocean liners. The construction of such a dock at New York has been the subject of much talk but little action. A 1,000 foot dock is liable to be at any time most urgently needed. Had the "Titanic" been able to crawl into New York harbor, she might have had to stay here indefinitely, for there is not a dock in the country that could accommodate her.

Surprise Signals for Locomotive Engineers.—In view of the many accidents on the New York, New Haven & Hartford Railroad, due to engineers running by signals, the company has ordered a series of test surprise signals. According to a dispatch from New Haven, the tests will include improper train orders, displaced switches and a number of changes of signals. Tests of this character act as a strong inducement to strict watchfulness and obedience on the part of trainmen generally. The practice is followed on several roads, we understand, with excellent results.

Perkin Medal for James Gayley.—The Perkin Gold Medal was recently awarded to James Gayley, formerly first vice-president of the United States Steel Corporation. Gayley is the seventh recipient of the medal, which was created in honor of Sir William Henry Perkin, the founder of coal tar chemistry, which revolutionized the dye and drug industry. The medal was awarded to Mr. Gayley for his invention of the dry-air blast for the manufacture of iron. This invention brought about a reduction of at least $1 a ton in the cost of producing pig iron, besides making it possible for the iron master to produce in all weathers a product of uniform quality.

The Selection of Locomotives.—In the paper before the American Society of Mechanical Engineers in this city, Mr. O. F. Bever, Jr., speaking on the question of the selection of locomotives in relation to the economics of railway operation stated that the main steps in this selection may be divided into: The consideration of the service, the nature of the business, the topography of the road, train speed, and train resistance, types and sizes of locomotives available, improvements to the permanent plant, effects of various types and sizes of locomotives on operating expenses, and the final selection of the most economical type and size of locomotive.

Length of Piers at New York.—On May 14th the world's largest steamship the "Imperator," is due at this port. She is 910 feet long. The longest permanent piers on the Manhattan side of the Hudson River are 825 feet long and these are leased by the Cunard Company. The White Star Company dock the "Olympic" at an 800-foot pier, which has been temporarily lengthened to 900 feet, but the extension must ultimately be removed. On the Jersey side the North German Lloyd has a 900-foot pier. The Hamburg-American Line, owners of the "Imperator," have an 850-foot pier. To dock the big ship this pier will be lengthened to 950 feet. Secretary Stimson's recent decision provides for 1,000-foot piers.

Cuniberti on Battleship Protection.—At a recent meeting of the Corps of Italian Naval Architects, Major-General Cuniberti doubted whether the means of defense of modern battleships of the dreadnought type had progressed proportionally to the increase in their offensive power. He considers that a naval battle at ten thousand yards would demonstrate that gun-power was "vastly superior to the resistance of the armor protecting the ship attacked." He would concentrate the protection, but he realizes the difficulty of determining exactly which sections of the ship should be more adequately defended. Very interesting to us is his statement that the dreadnoughts of almost all the navies, except perhaps those of the United States, are very deficient in regard to protection. Undoubtedly Cuniberti had in mind those two heavily protected ships, the "Nevada" and "Oklahoma," which we consider to be by far the most efficient all-round fighting units to be found in any navy to-day.

Electricity

Electric Trucks in Boston.—In 1902 the first electrically-driven delivery wagons were introduced in Boston. There were only two cars that year, in 1905 the number had increased to ten, in 1910 there were 119 electric trucks, and in 1912, 279, an increase in the last two years of 134 per cent.

Electrification of a Rocky Mountain Railroad Line.—The Chicago, Milwaukee and Puget Sound Railroad is to electrify 450 miles of its main line between Harlowtown, Montana, and Avery, Idaho. The Great Falls Power Company which will furnish the electric power has received a fifty-year grant from the Department of the Interior to transmit current over public domain under strict government regulations.

Transmitting Range of Arlington Station.—In order to determine the maximum range of transmission of the new wireless telegraph station at Arlington, Va., the cruiser "Salem" has been sent out upon a voyage over the Atlantic. The cruiser will endeavor to keep in touch with the Arlington station and determine the exact distance or distances at which signals sent out from Arlington cease to be perceived. It is believed that the Arlington station will be able to transmit over a radius of 4,000 miles.

Electric Service Table.—A table has recently been put on the market which is of the ordinary library type but is also provided with four or more outlets or plug sockets, inconspicuously placed on the side below the table top. This affords means for connecting up electrical apparatus such as fans, cooking utensils, reading lamps, etc. In an iron box secured to the under side of the top are a meter, main switch fuses and the necessary wiring. Connection with the lighting main may be made through a steel conduit passing from the iron box through the baseboard to the outside wall of the building. This simple device comprises all the electrical outfit necessary for the electrical comforts of a living room. By using extension cords a vacuum cleaner may be efficiently employed all over the house.

Electricity in the Drafting Room.—Two applications of electric heating in connection with drafting work are referred to in an English electrical magazine. One is the use of a portable combination heater and fan ordinarily employed by hairdressers to dry their customers' hair after washing, to dry the ink on tracings. This "wrinkle" shortens the time required to complete the tracing as the freshly inked lines must be dry before T-square or triangle can be moved over the tracing, and in the damp climate of the British Isles the scheme might find considerable application. The other idea, which has been used in this country also, is to dry blueprints by going over them with an electric flat-iron, and the flat-iron is also useful to straighten out tracings and prints that have been rolled or folded.

Mercury-vapor Rectifier of Large Power.—In the ordinary mercury-vapor rectifier using a glass vapor chamber the amount of electrical energy that can be converted from alternating to direct current has been limited, and the use of this form of energy converter has been confined to such comparatively small power applications as the charging of automobile storage batteries from alternating current mains and similar light work. A recent German type of rectifier has been developed for converting larger amounts of energy, the inclosing vessel being a sheet-steel cylinder. The gas-tight joint is formed by a double packing of asbestos or similar material with a layer of mercury in between. A 220-volt, 80-kilowatt rectifier of this type has been in use since November, 1911, supplying the power plant of an iron foundry for 10 hours daily, operating from single-phase 2,000-volt mains. A 100-kilowatt steel rectifier weighs only 1,000 pounds as compared with the 4,200 pounds weight of an ordinary rotary convertor of the same capacity.

Exploring for Gas with Electric Arcs.—During the excavation of the tunnel through the Santa Ynez Range in California for the Santa Barbara aqueduct, so much gas was encountered that special means had to be devised for the protection of the workmen. It was decided to ignite the gas with electric arcs. For this reason arcs were placed in pockets in the roof of the tunnel, about 200 feet apart. Half an hour after a blast was fired, the arc circuits were closed, and by means of ammeters it was possible to determine whether they were burning. If no explosion of gas resulted from this, the fire boss entered the tunnel and proceeded a distance of 3,500 feet to the second arcing station. Here the current was again switched on, and if there was no explosion, he proceeded with his gang of men to explore the tunnel with a safety lamp in search for pockets. This done, torches were placed throughout the tunnel at distances of about 100 feet apart through the section in which the gas was encountered, and were kept burning while the next shift was at work on the heading. Four hours were thus consumed in precautionary measures, between shifts.

Science

Solar Radiation Concentrated by Clouds.—In the Bulletin of the Mount Weather Observatory Messrs. H. H. Kimball and E. R. Miller call attention to the paradoxical fact that clouds, when favorably situated sometimes increase the intensity of radiation from sun and sky received by a body on the earth as much as 40 per cent over what would be received if the sky were perfectly clear, while increases of 10 per cent from this cause are quite common. This is shown by the records of the horizontally exposed Callendar pyrheliometer, which makes a continuous registration of the vertical component of the radiation from sun and sky, and the phenomenon is explained by the fact that radiation reflected from the cloud surface is added to that coming directly from the sun.

The International Map of the World on a scale of 1 to 1,000,000 will when completed eight or ten years hence cover a total area of about 1,840 feet by 75 feet, or the surface of a globe 40 feet in diameter. It will consist of about 1,500 sheets each representing a section of 4 degrees in latitude and 6 in longitude. The first sheet of the United States portion has just been published by the Geological Survey in Washington. It is known in the general scheme as "sheet North K 19," but will be more popularly known as the "Boston sheet," and embraces Rhode Island, and portions of New York, Connecticut, Massachusetts, New Hampshire, Maine and Nova Scotia. It is printed in six colors. Ocean depths and terrestrial altitude are shown by contour lines and graduated tints. It represents the beginning of a more accurate map of the United States than any that now exists.

Ozone for Preserving Meat.—An important improvement in the technique of cold storage has recently been introduced in Germany, viz. the use of ozone as a supplement to the ordinary process of refrigeration. In the cold storage rooms attached to slaughter-houses the temperature of the air is liable to be raised to a serious extent when the doors are left open for any reason, for instance when meat is being put in or taken out. The microorganisms of putrefaction immediately become active under such circumstances and the keeping quality of the meat is diminished. Now it is well known that ozone is a powerful germicide. If the air of the cold storage room is ozonized, its temperature may be raised without injury to the contents. This has been proved by numerous experiments, and ozonizing apparatus has now been installed in the abattoirs at Cologne, Potsdam, Brandenburg, Berlin, Frankfort-on-the-Main, Düsseldorf, Freiburg (Silesia), Aix-la-Chapelle and Erfurt, in a cold storage depot in Hamburg, and in various dairies, poultry and game stores and fish establishments.

The Progress of Aerology.—*Petermanns Mitteilungen* publishes an abstract of the presidential address of Prof. Dr. Hergesell at the seventh meeting of the International Commission for Scientific Aeronautics, held in Vienna, May 27th to June 1st, 1912. (This commission, by the way, has a misleading name, as it is not concerned with the navigation of the air, scientific or otherwise, but with meteorological investigations carried on with the aid of kites and balloons.) The president reported that since the commission last met, in 1909, twenty aerological stations had been added to the international *reseau*, including some in countries where no upper-air research had previously been carried on, viz. the Dutch East Indies, Argentina, Uruguay, Iceland and Canada. The commission has two observatories under its immediate direction, one on the peak of Teneriffe, and one in Spitzbergen. The former has made observations of the trade and antitrade winds up to an altitude of 11 miles by means of more than 800 ascents of pilot-balloons. The latter is making important researches on the atmospheric circulation around the North Pole, especially in co-operation with various Arctic expeditions.

Micrometer Positions of Halley's Comet.—In the *Astronomical Journal* (No. 10, Vol. XXVII) Prof. F. E. Barnard publishes some micrometer positions of Halley's comet made with the 40-inch telescope of the Yerkes Observatory. Prof. Barnard states that in the last few observations before its final disappearance it was excessively difficult to make the measures, partly because of the poor condition of the sky. Still Prof. Barnard is so accurate and skillful an observer that his data will undoubtedly be accepted by every astronomer. The small field of the 40-inch telescope made it difficult to secure proper comparison stars on observations. Hence it was necessary in many cases to connect the comet with a faint star near it and then to compare this with a known star. The positions of these intermediate stars are given in Prof. Barnard's paper. Prof. Barnard also publishes in the *Astronomical Journal* a few notes made at the time of observation, and promises to publish in a later paper the main mass of notes. "These last give a detailed description of the naked eye appearance of the comet, and I think," Prof. Barnard states, "will be of service to astronomers at future returns of this object. Such information seemed to be sadly lacking in 1910 in connection with the return of 1835."

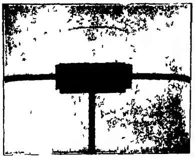


Fig 1.—Side view, showing cylindrical shape of wave

Fig 2.—A simple sound wave seen end-on.

Fig. 3.—Sound wave reflected from plane surface

Fig. 4.—The same wave, photographed a moment later.

Seeing Sound

Snap Shots of Waves Traveling at Seven Hundred and Fifty Miles Per Hour

IN our day one does not need to be a physicist to know that wave motion of one kind or another plays an important part in nature and in technical applications of natural phenomena. The simplest and most obvious type of wave motion, the one to which the name is primarily applicable, is that which we observe in the ripple in a teacup, a surface-tension effect, or in the mighty ocean billow rolling on under the action of gravitation. Such waves are essentially two-dimensional; at least their direction of propagation lies in a plane. A typical wave front in this case, such as that produced by a stone falling into a pond, is circular in form.

Other waves, and a very important class, are three-dimensional, the typical form being spherical, each wave starting out from a point source and spreading out as a sphere with that point as its center. Light waves are of this character, as well as the waves used in wireless telegraphy. In fact, as our readers know, the two are propagated with the same velocity through vacuum, and are identical in character except as regards their wave length, which is of the order of one fifty thousandth of an inch in the case of light, and of the order of several thousands of feet in the case of the electric waves commonly used in wireless telegraphy.

While the circular waves on a sheet of water are readily observable and known to every child, it is only by special means that spherical waves can be rendered visible. Light waves are themselves of course invisible—contradictory as this may seem. A beam of light passing through a perfectly dustless space is absolutely invisible to an eye looking across the beam. In this sense it may indeed be said that no eye has ever seen a wave of light. But there is another kind of spherical waves—sound waves—which, though ordinarily quite as invisible as waves of light or electromagnetic waves, can nevertheless, by suitable means, be rendered observable to the sense of sight. A particularly fine method for effecting this has recently been developed by Prof. A. L. Foley of Indiana University, in collaboration with Mr. W. H. Souder. By the kind permission of Prof. Foley and the courtesy of the editor of the *Physical Review*, in which the first account of this method appeared, we are enabled to give here an indication of the nature of the process followed, and to show some of the very fine photographs obtained.

The method is best explained by reference to the diagram Fig. 5, which shows the apparatus employed.

Four spark gaps S, I, T_1K_1 and T_2K_2 are arranged in series in a circuit in which a large electric induction machine is included.

The gaps T_1K_1, T_2K_2 serve merely as a means for producing a spark at the desired moment by turning the glass plates GG out of the way—these plates being normally interposed between the knobs T_1K_1, T_2K_2.

Every time a spark is thus caused at T_1K_1, T_2K_2, a similar discharge occurs at the gaps S and I also. The sound gap S is so arranged as to give a loud discharge, thus sending out a sound wave consisting of alternate layers of compressed and rarified air. The gap I, on the other hand, has its terminals made of magnesium wire, so as to give a brilliantly luminous discharge. The Leyden jars K_1, together with other features that cannot be discussed in detail here, serve to delay the discharge at I so that it occurs by a minute fraction of a second later than that at S. Hence the light from I arrives at S when the sound wave has traveled a certain distance out from its source. A photographic plate (or the observer's eye) is placed at P, and as the layers of air of different density of which the sound wave is formed, have different refracting powers, the appearance shown at P is that of a dark ring on a light background.

The waves produced by this apparatus are not strictly spherical in form, but consist of cylinders with hemispherical ends. As these are viewed end on, however, the appearance presented is exactly the same as if we were dealing with spherical waves.

Of the photographs so obtained we reproduce a few typical examples. Fig. 1 is a broadside view showing the cylindrical form of the wave. A simple transverse

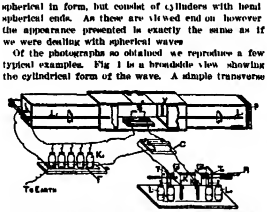


Fig. 5.—General view of apparatus employed in photographing sound waves.

section is shown in Fig. 2. Very interesting is Fig. 3, which shows the appearance presented when the wave hits a reflecting plane obstacle ("mirror"). The forward part of the wave (on the right) travels on unchanged, but a similar secondary (reflected) wave is produced at the reflecting surface and travels out in pursuit of the original wave as seen in Fig. 4, which represents the state of affairs at a slightly later instant.

The action of a lens (sulphur dioxide contained in a collodion envelope) is shown in Fig. 6. It will be seen that the wave starting from the focus of the lens on the right, emerges as a plane wave (parallel rays) on the left. A similar effect produced by a parabolic mirror is shown in Fig. 7. Here also the wave emerges after reflection as a plane wave. A very interesting case is shown in Fig. 8. A wave starting out from one focus of an ellipse (at which the knob of the sound gap appears) is reflected and brought to a point at the other focus of the ellipse. Finally, a very fine interference pattern is produced, as shown in Fig. 9, by a cylindrical grating placed in the path of the sound wave with the source at the center.

It may be remarked that more recently Prof. Foley has further extended his researches, using the method here outlined, for the study of the electric spark discharge.

Those of our readers who may be interested in the details of the experimental arrangement designed by Prof. Foley will find a full account of these in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

The New Campanile at Venice

THE new campanile of Venice shows some interesting points of construction. When it was decided to rebuild it, the principal question was to provide against a repetition of the catastrophe which befell the original tower. It is known that Venice, constructed as it is upon the lagoons, gives a very defective foundation soil, and this appears to be the reason why the old campanile fell down, owing to the overloading of the foundations. In fact, the tower had 280 feet height and over 13,000 tons weight, and gave a pressure of 1.3 tons per square foot upon its foundations. In erecting the new tower the commission provided for better conditions by strengthening the foundations and at the same time lightening the weight of the construction by another method of building, also by consolidating the different parts of the tower so that there is no danger of dislocation. Reinforced concrete came in very well to carry out these ideas, and it enabled the engineers to give more space to the interior without changing the outside appearance in the least. The side walls are now very well joined together by means of the spiral staircase which passes up through the center of the tower so that the whole mass has a much greater solidity than before. The use of reinforced concrete allowed of reducing the thickness of the walls considerably, and the new construction now has three quarters the weight of the old one. For the foundation over 1,000 new piles were driven so as to make it much stronger than before. The piles uphold a foundation base in hard stone, and the load upon the ground is now reduced to 4.7 tons per square foot, which is well within safe limits. The spire which terminates the tower and is 98 feet in height is well braced inside by reinforced concrete members and rests upon a platform foundation of the same material. Only the framing for the support of the bells is of metallic construction. The elasticity of this part as well as the greater flexibility of the whole edifice, is counted upon to reduce the oscillations of the tower upon the foundations due to the effect of the wind and also the vibrations caused by the bells. It is thought that these effects played a large part in the destruction of the former tower, and that they will now be overcome to a great degree. On the whole, the builders used great pains not only to keep the outside appearance of the tower as nearly like the old one as possible, but to redesign the body of the construction on the most modern principles in order to obtain the greatest possible strength, and thus diminish the likelihood of any similar accidents in the future.

Fig. 6.—A lens converts a spherical into a plane wave.

Fig. 7.—Similar effect produced by a parabolic mirror.

Fig. 8.—Reflection from one focus of ellipse to the other.

Fig. 9.—Diffraction pattern produced by a grating.

Co-operation in Educational Effort

THE recently issued annual report of President MacLaurin of the Massachusetts Institute of Technology discusses the need of co-operation in educational effort. To the students and alumni of the Massachusetts Institute of Technology the question is one of great importance in view of the proposed merger of the Institute with Harvard University. Admitting that there has been much friendly co-operation between Harvard and Technology, and prophesying an even closer relation in the future, now that the Institute is about to move to Cambridge, President MacLaurin nevertheless maintains that with regard to any scheme that might be proposed to meet the actual conditions at Harvard and Technology, it is impossible to maintain extended co-operation with any satisfaction to either institution, and consequently with any chance of permanence unless the idea of competition is eliminated. Furthermore, he maintains that extensive co-operation to be worth much consideration must be broad enough to throw open the resources of both institutions (in equipment as well as in men) to at least some of the students of the other. He also insists that the obvious way to co-operate is in the treatment of the graduate students, leaving the greater part of the Massachusetts Institute of Technology entirely alone.

The necessity for co-operation in educational effort is nowhere more apparent than in the relations of technical institutions to our universities. Education suffers in few ways so much as through lack of co-operation among those colleges, universities, and schools of applied science which not only should be laboring together for the common good, not only should be avoiding by agreement those duplications of resources and of effort that keep them all painfully poor but also should be devising some plan by which students may be transferred from one to another without loss of time and effort.

A few examples may give definiteness to these general statements. If Harvard were to duplicate the complete mining and metallurgical laboratory which the Institute of Technology is planning to build and equip, the community would be called upon to expend hundreds of thousands of dollars for mere duplication, and yet all the students of mining and metallurgy at Harvard could easily be accommodated in the Institute's new laboratory without detriment to the Technology students. Similarly it would be folly for the Massachusetts Institute of Technology to spend hundreds of thousands of dollars to duplicate the University's museum, whose great collection of minerals and fossils might be opened to the senior students at Technology without inconveniencing the regular students of Harvard. The building of an experimental tank in the Institute of Technology a step considered by competent authorities to be a necessary part of a department that is fully equipped to advance the science of shipbuilding would suffice very easily for two or more neighboring institutions.

Such duplication, however, does not represent the entire waste of the present system. "More serious than any duplication of machines," says President MacLaurin, "is the loss that falls upon the community by excluding advanced students of each institution from the benefit of coming under the influence of the pioneers of science in the other institution, men whose character and attainments make any suggestion of duplication absurd. For years the advanced students of geology at this Institute have been stimulated by Prof. Daly's skill and enthusiasm as a teacher as well as by his scientific achievements. Now that he has gone to Harvard, it is regrettable that such students should be cut off from his influence, especially in view of the fact that the advanced students of Harvard and Technology together would not be too many for a man of his capacity to deal with effectively. Indeed, in such cases there is a loss rather than a gain in efficiency, merely from the educational standpoint, where the number of students is unduly small."

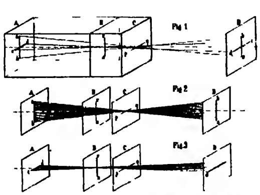
President MacLaurin's discussion of efficiency in education was rendered necessary by the decision that there can be no merger with Harvard. The Institute seems strong enough to stand alone or to enter, if it wishes, into relations of co-operation in educational effort. Because the latter term might be misunderstood, and serve for a cause of dissension, President MacLaurin laid down the broad fundamental principles of co-operation with Harvard.

Anomalies in Automobile Terminology.—Automobile terminology, to many of those who call themselves engineers, must be a despair if their efforts at elucidation and the naming of parts can be taken as a guide. Despite the evident redundancy, apparent in the derivation of the word "pedal," "foot pedal" is one of the most common of errors that appears in nearly every piece of automobile advertising, while one "engineer" who would be more than ordinarily explicit has advertised that the brake is operated by the "right-hand foot pedal."

The Slit Camera

By Our Berlin Correspondent

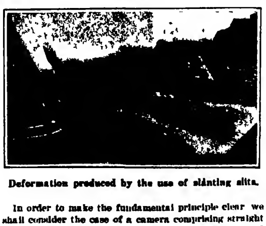
THE slit camera, designed by Mr. Wolfgang Otto, of Kiel, Germany, is an ingenious device on the pinhole camera type, and is intended for producing any distortion desired. It comprises on the side turned toward the object, two crossed slits arranged in partitions situated behind one another. The slits may be straight or curved, of any width desired, and the distance of the partition from the plane of the image may be varied at will. The partitions may also be curved or slanting if desired. The camera can, of course, be designed at will as folding camera, bellows camera, etc.



The Otto slit camera for producing distorted photographs

Block of houses fore-shortened vertically by the slit camera

The same block with vertical lines exaggerated in length



Deformation produced by the use of slanting slits.

In order to make the fundamental principle clear we shall consider the case of a camera comprising straight slits of uniform width, the plane of the image A and the partitions B and C being vertical, while one of the slits ($p\ q$) is horizontal and the other ($r\ s$) vertical. The picture of the object $a\ b\ c\ d$, which is then produced on the screen D shows a deformation, the scales in a horizontal and vertical direction, respectively bearing to one another the same ratio as the distances of the two slits from the focal plane.

If we follow a moving point along the line $a\ b$ of the object at D (Fig. 2), the beam of light passing from such point to the image screen at A will, as it were, pivot about the slit $p\ q$ in the partition C. Similarly if the point of the object considered moves horizontally along $c\ d$, the corresponding beam of light will pivot about the slit $r\ s$ in the partition B and the same applies to the horizontal beam of rays represented in Fig. 3.

Thus vertical lines of the object are thus gathered into an image at A by the slit $r\ s$ while horizontal lines are similarly gathered into an image by the slit $p\ q$. Owing to the difference in the distance of the two slits from object and image they form two images of different magnitude. But this amounts to saying that the resultant image represents vertical and horizontal features of the object on two different scales—or in other words the resultant image is distorted.

Other deformations may be produced by providing slanting partitions, slits of varying width or curved. In many cases the conditions determining a given deformation can be found by calculation. Moreover instead of a single slit any number of slits can be provided in the same plane.

The slit camera is not a mere scientific toy but can serve many useful purposes. Thus it may be used for rapidly altering architect's plans, or for producing comical caricature effects by deformation, for varying any given pattern for fabrics or carpets, and for altering the different forms of type.

The slit camera can be readily made by everybody and will be found an inexhaustible source of amusing experiment.

Popular Ignorance About Our Common Woods

MODERN culture in no small measure despises natural history. Wood experts observe constantly from their intercourse with their fellows that even among the well educated people there prevails a general lack of acquaintance with the commercial woods. Among the wood users of the present day what knowledge they have upon the woods is generally that of a few superficial and unrelated facts mixed, perhaps, with a number of incorrect ideas concerning their physical properties and their suitability for certain uses. It is also a rather remarkable fact how prone people are to confound the names of well known species of woods, which though closely related possess notwithstanding clearly marked distinctive characters. Thus, experienced lumbermen or timber merchants call spruces firs, pines spruces, maples "sycamores," and even trained foresters sometimes class the cigar box cedar (*Cedrela odorata*) with our common red cedar or juniper. This confusion of knowledge exists also with relation to species which have been made familiar to a number of laymen in the local lumber yards where for instance western yellow pine is sold as white pine, and red oak as white oak.

There is no material in such common use as wood, and it may be from this very circumstance of its being so plentiful that it is looked upon by people as beneath their notice. The average man in the street is unable to tell the distinctive features of the wood of ash and that of chestnut, and he does not regard such facts entitled to any consideration. The same person would feel offended if he were told that he did not know the difference between a mushroom and a toadstool, as a matter of fact there is no botanical or other distinction whatever. A knowledge of the chief external appearance of wood and their more prominent structural characteristics will be found upon investigation to be highly interesting and often prove to be of considerable value. It is a knowledge and understanding of the characteristics of our common woods by which the relation of structure and external features is clearly indicated and defined that the people generally are most lacking. Not many possess the ability to group woods having like structural characters.

The study of woods has indeed latterly received more attention than formerly as a branch of education and made a part of the courses given in forestry and other technical institutions. It should be made a part of the common school exercises. But the teachers have themselves no very clear understanding of the characters of the chief commercial woods, and a short course of instruction must first be introduced into our training schools for teachers. Instructions of this character can fitly be introduced in connection with sloyd work.

There is hope that the coming generation will be better posted upon the principal characteristics of woods. In this respect the people of Germany have progressed considerably more than the English or the Americans. The Latin names employed for a good many structures in wood have been perhaps the chief difficulty, and discouraged many persons from acquiring a better knowledge of woods. This difficulty is now fast disappearing, for easier terms are being applied to such structures which are most essential to a knowledge of woods.

Building a Four-track Tunnel Beneath Broadway, New York

DWELLERS in Manhattan, and outside of it for that matter, will long remember the intolerable discomfort which attended the construction of the present subway. Unsightly cableways stretched above chasms which yawned where once the street had been, sidewalks were littered with timber, tools and the various impedimenta of the contractor, carts backed up to receive the excavated material, selecting loading positions which, though they may have suited the convenience of the contractor, certainly had no reference to the comfort of the street and sidewalk traffic. Dust in summer, dirt in winter—obstructions everywhere, the four or five years spent in building the first subway developed a prejudice against the new transit system, which it took all of the road's admitted excellence for the first year or two of its operation to dissipate.

We learned well the lesson taught in 1903 and adjacent years. In 1913 we are again building subways, but we are doing it with many notable differences, the chief of which is that the many nuisances which accompanied the earlier work have been entirely abolished from the new work. Formerly a whole section of the street, or if that particular neighborhood were fortunate, one half of the street, was closed and a huge open excavation was maintained until the work had been carried down to the full depth. That was what the engineer calls excavation by "open cut." To-day our subways are built by what is known as the "cut-and-cover" method, which is being so carefully and conscientiously followed, that a large proportion of the millions of people that pass up and down Broadway on foot, in motor, or on street-car, are in complete ignorance of the fact that a four-track express railroad is being built in a tunnel immediately below.

On the front page of the present issue is a drawing which explains how this work is being done. The view is taken on Broadway at the point where the new City Hall Station of the new Broadway line is being constructed. South of the City Hall the route lies under the streets to the west of Broadway until it reaches the Battery, when it passes below the East River to a junction with the Brooklyn Rapid Transit System. North of City Hall Park the subway extends up Broadway to the neighborhood of Times Square, and thence up Seventh Avenue to Fifty-ninth Street, where it will turn to the east through Fifty-ninth Street and cross the Queensboro Bridge to Long Island City.

The section of the work herewith illustrated, which is being built by the Degnon Contracting Company, to whom we are indebted for courtesies in our examination of the work, extends from Walker Street to Park Place, a distance of about 2,800 feet. The tunnel contains four tracks as it approaches the station, which contains five tracks. Two of these are carried on an upper deck, the other three below, the total depth of the excavation here being about 41 feet, and the total width something over 75 feet. The material is favorable for excavation, being entirely sand, of which there are in this section about 250,000 cubic yards.

A most important work, preliminary to the excavation, was to remove two gas mains, 12 inches and 16 inches respectively in diameter, temporarily from the excavation and carry them above ground—this to guard against possible explosions due to leakage. The mains were diverted at each end of the work, and carried above the sidewalk upon temporary trestles, as shown in the front page engraving.

The first operation in excavating by the "cut-and-cover" method is to sink a series of shafts, placed generally on the side streets, just off Broadway. These shafts on the City Hall section were sunk at the Park and at Worth and White streets, and they were carried down to the depth of the first bench of the excavation, or say about 16 feet. The next step was to remove the street paving for its entire width and for a length along the street of forty or fifty feet, and lay down a series of parallel longitudinal 10-inch by 10-inch timbers, spaced five feet apart. On these was laid a roadway of 5-inch plank. The space between the two tracks was covered by two layers of planking, one of 3-inch and one of 4-inch, the first transverse and the second, or upper layer, longitudinal. When this was done a smooth roadway of timber was thus provided in place of the asphalt or Belgian blocks.

The excavating gang then entered the side shafts, and with pick and shovel began to excavate across the street. As the work advanced, they placed 12 by 12 posts beneath the 10 by 10 timbers which carried the roadway planking, the excavation being carried on until it was completed to the opposite side of the street. Temporary footings for these posts were placed on the bottom of the excavation; the transverse lines or bents of supporting timbers were placed ten feet apart, measured in the direction of the street.

The excavation and timbering, as thus described, was carried down to about the 16-foot level below street grade. Above this level, it will be remembered, the supporting posts were placed at 10-foot intervals; below, the character of the construction made it necessary to place the posts at 20-foot intervals. Moreover, it was desirable to put these posts, which were 25 feet long and reached to the final bottom of the excavation, in place before the dirt was taken out. To do this, timbered shafts measuring 3 feet by 4 feet were sunk down to subgrade, and into these the 25-foot 12 by 12 posts were lowered, a concrete slab having been prepared at the foot of each shaft, as a footing or foundation. At the top of the 25-foot posts were the caps and longitudinal stringers, upon which the upper and shorter lengths of posts rested, and which served to tie the transverse bents together. The whole system of falsework was thoroughly braced, as shown.

The excavation was done by pick and shovel, the dirt being loaded into buckets, on small contractors' cars, which were pulled back from the headings to the hoisting shafts either by mules or electric locomotives, where they were hauled up by electrically operated derricks and dumped into hoppers. The latter were built on platforms spanning the street or the sidewalk, which were capable of holding thirty yards apiece. From the hoppers the material was dropped directly into the contractor's carts, which carried it to the dump or wherever it was being disposed. The disposal of the excavated material is one of the serious problems of city subway construction.

Some very successful excavating was done by means of a belt conveyor and elevator. The conveyor extended across the cut opposite the hoisting plant, which was located in the shaft near the corner of Chambers and Broadway. The material was hauled in cars by electric locomotives, dumped into a hopper, loaded onto the belt conveyor, and carried to the boot of the elevator, whence it was taken up and deposited in hoppers upon the platform.

During the progress of excavation the sidewalls of the tunnel are protected against caving in by means of three lines of vertical sheet piling driven as shown in our front page illustration. The piling is braced by a series of 10 by 10 struts, which are carried back and bed against the longitudinal timbers of the 25-foot carrying posts already referred to.

When the excavation had been carried down to subgrade the heavy floor of concrete about 2 feet 6 inches in thickness was laid, and the work is to-day so far advanced that the concrete floor is completed for a length of 500 feet.

The next step will be the erection of the steel columns, the construction of the steel work of the floor and roof and sidewalls, and the turning in of the concrete arches which, with the embedded steel, will form the sidewalls and roof of the finished structure.

An important and costly section of this subway building is the provision which must be made for supporting the front walls of the buildings which line the route of the tunnel. In the case of the more recent buildings, whose foundations have been carried down to rock, no change is necessary; but in the case of older buildings, such as the Stewart building shown on the right in our illustration, whose foundations were far above the bottom of the tunnel excavation, it was necessary to resort to "underpinning."

Steel needle beams were run at intervals through the foundation walls, their ends resting upon timber posts of sufficient strength to carry the entire load of the front wall. Masonry was then built in below the wall until the latter continued without a break down to a point slightly below the floor of the subway.

It will interest the readers of the SCIENTIFIC AMERICAN to learn that the first tunnel below Broadway, constructed over forty years ago, on the plans of the late Alfred Ely Beach of the SCIENTIFIC AMERICAN, was located at the point where the section shown on our frontispiece was taken.

Our thanks are due to Mr. Burdette Kipp, assistant engineer, and Mr. R. P. Hustin, engineer in charge, for their courteous assistance in furnishing opportunities for the preparation of this article.

A Feathering Air Propeller

IN the mechanical engineering laboratory of Columbia University a test was recently made of a feathering air propeller invented by Ciro F. Mendez. The propeller was eight feet in diameter and weighed 193 pounds. Of this weight 76 pounds was the weight of the blades and 117 pounds the weight of the hub and the mechanism for feathering the blades, a weight not excessive for a dirigible airship propeller.

In carrying out the test the propeller was mounted on a frame free to move in a horizontal direction by the action of the propeller upon the air. The amount of thrust was measured in pounds by a spring balance. Power was applied from an electric motor through belting in such a manner as not to affect the movement of the table; in other words, power was applied directly over the center of rotation; the weight of the frame of the propeller was carried upon anti-friction rollers, and the friction error was eliminated by measuring the pull, including the friction and minus the friction, adding these together and dividing the result by two. A series of runs 155, 200, 250 and 300 revolutions per minute were made and the amount of current and thrust recorded. After the capacity of the apparatus had been learned, a brake pulley was attached to the propeller shaft and arrangement made for reading directly the amount of power transmitted to the propeller. In this series of tests, the propeller was driven at each of the speeds referred to and the readings of the voltmeter and ammeter recorded; also, the thrust of the propeller. Then the coupling in the propeller shaft was disconnected, the brake band and the brake attached, and the test run at the same reading of the voltmeter and ammeter, thus determining the actual power delivered to the propeller and eliminating the electrical and mechanical efficiency of the motor, belting and shafting.

The amount of work done by a propeller is its resistance against revolution, measured by its thrust, multiplied by the distance of travel of the center effort of the blades. The radius of this center of effort was 3.06 feet from the center, the resistance of a radial surface of rotation varying as the square of resistance from the center of revolution. The product of these two forces divided by 33,000 expresses the work done by the propeller in horse-power, and the reading of the brake determines the actual power applied to the propeller. The efficiency of the propeller was then determined by dividing the work appearing from the action of the propeller by the total power applied to it. From this it appeared that the efficiency at 155 revolutions was 70 per cent, at 200 revolutions 70.5 per cent, at 250 revolutions 75.2 per cent and at 300 revolutions 88 per cent. This may be considered an exceedingly satisfactory result. A thrust of 39.12 pounds was developed for an expenditure of 7.73 horse-power, which force is available at any time in any direction, for by revolving *a cam* which controls the *feathering of the blades*, it is possible to apply the thrust to drive the airship ahead or backward, to cause it to rise or descend without interfering with the speed or action of the engine.

Molecular Structure and the Origin of the Elements

CONCEIVED in the mind of ancient Greek philosophers, the atomic theory of the "grained" structure of matter was revived in 1803 by John Dalton to account for the fundamental law of chemistry, according to which every compound contains a definite and invariable proportion of its constituent elements. But the atomic structure of matter interests the physicist quite as much as the chemist; for is it not, according to the kinetic theory, the impact of gas molecules against the walls of the containing vessel which causes the gas to exert a pressure on these walls?

And we have long ago grown accustomed to look upon heat as "a mode of motion"—the dance of the molecules. But while these qualitative conceptions of the grained structure of matter are comparatively easy to comprehend, it has taxed the ingenuity of men of the highest scientific genius to develop the mathematical theory and to enable us to calculate the size of hydrogen molecules, of which forty-two million millions could be packed into the volume of a single blood corpuscle! And it is the triumph of experimental skill not only to have rendered visible to the eye that very dance of the molecules, but to have actually counted them one by one, taking advantage of the flash of light which an α-particle, a helium atom, gives out when it is shot out from a radio-active substance against a sensitive screen. And here the phenomenon of the grained structure of matter brings us face to face with another great problem. If there are different kinds of atoms, how came they by their several characteristic properties, the oxygen atom, for example, being invariably sixteen times as heavy as the hydrogen atom? Radium seems to hold a clue to this problem. It appears that some, at least, of the elements of higher atomic weight are continually undergoing disintegration, each atom of such element splitting up into others of lesser weight. And one product of the disintegration of radium is helium, as has been shown beyond doubt by Ramsay, Rutherford and others.

Have we then achieved the transmutation of the elements? Yes and no—yes, for radium is transmuted into helium and other products; no, for we have no control whatever over this excessively slow transformation.

This was but yesterday. To-day, if first accounts received prove authentic, we may answer our question with an unqualified "yes." For we read in the daily papers that Sir William Ramsay and Professors Norman Collie and H. Patterson have found newly formed helium and neon in bulbs originally containing hydrogen at a low pressure, and submitted to the influence of an electric discharge. This, then, so far as one is able to gather at the present moment, seems to be a definite case of transmutation (if not of creation) of elements under controlled and reproducible conditions.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Panama Canal Problem in 1638

To the Editor of the SCIENTIFIC AMERICAN:

When was a Panama canal first thought of and discussed? It must be a very long time ago, because I have just been looking through a very old and very interesting book of mine on commerce, published in 1638. It gives a map of each continent as then known, and mentions with particulars of each all the towns available for commerce in each. The map and descriptions of the towns in America are naturally rather primitive, but the following paragraph occurs with reference to Central America and is, I think, of special interest at the present time: "Peruana contains the southern part of America, and is tied to Mexicana by the Straight of Darien, being 10 miles broad, some hold the Spainards did once intend to cut this straight through and make it navigable, and thereby shorten the way to the South Sea, China, Mollucoes, but hitherto we have not heard that the same is any way attempted."

I thought your readers might be interested in this extract. H. ALLAN MORGAN.

Holmwood, Knutsford, Cheshire.

Electricity as a Factor in Plant Growth

To the Editor of the SCIENTIFIC AMERICAN:

From time to time reports have gone out as to the effects of electricity on the growth of plants. Nearly all of these effects are alleged to have been observed in close proximity to lines carrying heavy currents, but as yet little has been done in the line of observing the effects of this all-pervading but mysterious force. It is possible and probable that electricity will yet be found to play an important part in the growth of vegetation, and who can tell but what, when it is once understood, we shall see it working as great wonders along this line as it has along others.

As an instance of the room there is for the study of electricity as it affects plant growth, I shall relate an experiment I performed the past summer.

I had noticed that nearly all weeds are well provided with points. I also noticed that such plants as sugar beets, cabbages, etc., that are not provided with points, are affected by the close proximity of weeds to an extent out of all proportion to the amount of fertility the weeds would rob them of, and they are much more seriously affected by the weeds than are other plants that are provided with points.

Now it is a well-known fact that the atmosphere is charged with electricity, and that electricity is most readily taken up by points. I went ahead on the supposition that plants take from the air the electricity it is charged with, and that in some way this electricity is necessary for their best growth. I supposed that the unusually bad effect of weeds on smooth-leaved plants might be due in a measure to the electricity the weeds robbed the other plants of. In order to test my theory, I selected a sugar beet and a cabbage and kept them well cultivated, but set up among the foliage a number of wires with sharpened points and left them there during the season. The result was that these plants showed a much smaller growth than others not so treated.

So far the experiment seems to have borne out my supposition that electricity does materially affect the growth of plants, and that the points on plants are important agents in gathering this force. If on further investigation this supposed law holds good, it would play an important part in the selection of varieties best suited to avail themselves of the electric energy. There are many things about plant growth and soils that are but meagerly understood, and this field would seem to be one of the most interesting and profitable for scientific study.

Almena, Wis. R. E. DIMICK.

Ideal Automatic Train Control

To the Editor of the SCIENTIFIC AMERICAN:

Much valuable space has been given of late in your publications as well as others to the problem of automatic train control. For more than twenty years inventors have been working on this problem, and all along the same lines, that is to say, they try to provide means whereby a locomotive will be arrested automatically should it pass a signal set at danger.

The inventors have been working along this line because the heads of railways concluded that these disastrous accidents are due to the locomotive passing a signal set at danger. As in every other problem, the cause must be first found before the remedy can be applied. The inventors took the fact that "the locomotive passes a signal set at danger" as the cause. This is true, but why not investigate, and find the cause for the disobedience of a signal set at danger?

One of the railroads, about which there has been much discussion of late, gave out "specifications" setting forth the different characteristics which they expect an automatic train control to possess before they will consider the adoption of the same. Let me point out in this connection that even if this railroad company should find a system that will do all those feats set forth in its 'specifications,' this railroad company will be greatly disappointed if some time after the installation of such a system they should read in the 'extras': Big railroad wreck. Forty killed.' Let me point out now that a system that will arrest a locomotive only on passing a signal set at danger, might at times protect the trains and at other times it will not, and the chances are just as much one way as they are the other.

Assuming a "block" to be a mile long and a train stalled at the end of this block and assuming further that the mechanism operating the roadside device is in good condition, then any locomotive passing this roadside device, which was set to danger by the stalled train will be arrested and brought to stop in time enough to protect both trains. The same thing will happen if there should be a broken rail near the end of the block. But all this assumes 'ideal' conditions, i. e., all obstacles at or near the end of the block and the fact that these obstacles can just as well be at the beginning of the block is ignored. No system such as outlined above, could ever protect a train if the train be stalled 200 or 300 feet from the beginning of the block, nor could it protect the oncoming train if there be a broken rail within 200 or even 500 feet from the beginning of the block.

I do not think that a roadside device could be designed which would have a greater operating efficiency than the present-day automatic signals. Yet, perfect as these signals are, they do fail at times; and as perfect as such a roadside device may be, it will fail at times for the same reasons that the signals fail. The roadside device might be operated independently of the signal, yet it is possible for the track relay in both of the circuits to stick. Track relays often remain energized by stray currents which act the same as though the block occupied by a train were clear, and the track relay for the roadside device would not be exempt from such a condition. There are many other conditions that have not been considered in the search for an 'ideal' automatic train control, and in which cases a train control such as outlined above, would prove useless.

Thus it will be seen that the steps taken so far to solve this important problem are not altogether the right ones and the solution lies elsewhere, but it does exist, and I know it will come. MAXIMILIAN WEIS.

The Real Problem of the Mississippi

To the Editor of the SCIENTIFIC AMERICAN:

The question of protection of the Mississippi River bottoms from overflow and the matter of canalization of the river from various points has been discussed in documents, which some of the debaters on these questions may not have read. The idea of building reservoirs on the headwaters of the Mississippi, for example, was put into one of the first of the many studies of the hydraulics of the great river by Mr. Charles Ellet, who afterward won renown as a fighting man during the civil war.

The classic report of Capt. A. A. Humphreys and Lieut. H. L. Abbot submitted to the Bureau of Topographical Engineers of the War Department in 1861 is, of course, the original source of much information on the Mississippi. The abbreviated "Levee System" is, perhaps, the more familiar edition of this report. The report very clearly and apparently irrefutably exploded many of the theories which to this day crop up in any argument—the reservoir notion, for example. The army officers, after the manner of their kind, collated everything that had been discovered about the Mississippi and its tributaries. They even gave the then meager rainfall records from the far and scattered forts on the westward slope of the river basin, for instance—those forts where army men in the lonely routine of their daily lives, turned from the parade grounds to study birds and mammals and the lay of the land, enriching the literature of natural history—for instance, Capt. Bendire and Dr. Elliot Coues.

James B. Eads was the one, who after the civil war led in the combat against the Mississippi. His distinguished service led the SCIENTIFIC AMERICAN to propose that he be made president, and if he had been made president, the Mississippi River problem would not now be the brain teaser of all the solvers of the "How Old is Ann?" question.

The trouble with the Mississippi is that it fills up its channel with sediment, and the Government keeps right on building up the levees, till they are as high as the platform of the gallows of Haman, upon which they cut from under, and leave some people literally hanging to the grapevines. Mr. Eads said in effect that the levees should be built out from the highlands on the east and west side of the river valley perpendicular to the river channel. Then the overflow would be "eddied" and the sediment deposited among the trees. I have seen in a caving bank, and in a hollow tree places where sediment deposits were twenty feet deep—this in eddies of old. The purpose of the eddies, in pools made by earth dams across the bottom, perpendicular to the flow of the river, would be twofold: first, to build up the bottoms lands; second, to make the current swift enough to scour out its own bed and carry the sediment till it swung out into the eddies out of the channel or on to the Gulf. Incidentally, the dams would serve as refuges.

That is to say, the greatest and till then the only thoroughly equipped student of the Mississippi solved the problem upward of forty years ago; but so perverse are the gentlemen who take levee contracts, and so conservative are the gentlemen who have the power, that the obvious remedy and so far as any one has ever discovered, the only remedy, has never been applied except when the river itself roars through that tremendous folly, the levee system as built in recent years. I have not the figures here, but I question whether the floods last year were as great in volume as the previous floods, those of 1844 or of the early 80's.

I would suggest as food for reflection the fact that the streets of New Madrid were overflowed last spring for the first time; measurements of the river surveyors show that in four or five years the river channel in front of New Madrid filled in more than five feet. Below New Orleans it filled in nine or ten feet. No wonder that levees with only a margin of a few inches, or eighteen inches, fail to hold when the place where the current is swiftest is deprived of a depth of five feet of freeway.

Those who desire to verify these statements may do so by referring to the Report on Survey of Mississippi River, Document No. 50 of the House of Representatives, Sixty-first Congress, first session, and to the reports of the Mississippi River Commission, especially for the year that describes the flood of 1903.

In addition to this study of the documents of the Mississippi River, the gentlemen desiring to know what is the matter with the river and with the controllers of the river should by all means go down the Mississippi and take jobs on the mattress work, perhaps pull an oar for the river surveyors—I think they use motor boats now, but when I was down there they rowed—and listen to the things the men on the jobs say. A few hours in a levee camp, sitting around the commissary stove along toward the end of a levee contract, will add interesting supplementary evidence to that found in the documents. Sometimes it gets into the documents, for none writhes more under the political phase of this matter than the honest officers. It was on the Mississippi job, for example, that the army men waited for the hour when the nation would call them to the honest effort at Panama. Consider their feelings when they sent dredges to Wolf River at Memphis year after year to take out sawdust.

The men who conquered Panama could conquer the Mississippi River; let no one doubt that. But just as long as the men on the Mississippi River job are held to the whims of congressmen and senators and levee boards, and even to the demands of cotton planters who own three miles fronting on a Government levee, just so long the Mississippi River shall go on its course filling up its bed with 200,000,000 cubic yards of material, while the Government keeps on piling up its little levee system on both banks, doing very little permanent or adequate work.

On page 40, "Survey of the Mississippi River" (1909) is a little table. It tells how much the annual cave is in various river bends. The average from Cairo to Donaldsonville is 9½ acres to a depth of 93 feet, or 1,003,570 cubic yards. The distance by river is 885 miles. That is 850,000,000 cubic yards of material washed down stream. During nine months of the year floating sediment to the quantity of 187,000,000 cubic yards came down the Missouri into this lower river. Besides this floating sediment, the river of mud, sand and gravel at the bottom of the water must be reckoned with. In all the Missouri is dumping fully 300,000,000 cubic yards into the Mississippi, where the Government is heaping up three or four million cubic yards of dirt a year, to counteract the effect of this channel deposit.

Why not bring the men who dug the Panama Canal back to the Mississippi and give them the opportunity to assail their ancient enemy, unimpeded by the contemptible politics that has restrained the impatient men who know what to do and would do it to the everlasting advantage of the country? When those men were beyond the reach of the picayune influences, and were left at least sufficiently alone in their work they conjugated the verb To Do.

They are the men who know; they don't own cotton plantations, nor boom swamp lands, nor sit on railroad directorates, nor speculate in sugar and rice; they see their duty, and the one thing in all the world that they would rather do is their duty. All that stops them is the—we all know, and the more shame to us since we do know.

Give them a chance!

Little Falls, N. Y. RAYMOND S. SPEARS.

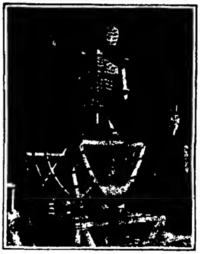


Fig 1.—Armature for the "Whaleman" by B. L. Pratt

Fig 2.—Pointing machine used to transfer from the model the location of nose, chin, etc.

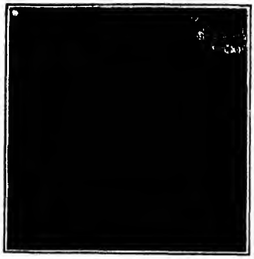


Fig. 3.—The flask consists of iron sections clamped together.

The Art of Making Bronze Statues

From the Raw Clay to the Finished Figure

By C E Fairbanks

THE artist who portrays his conception in bronze encounters many obstacles which his brother of the palette and canvas never has to contend with. Among other difficulties is the fact that the work of the former has to pass through several hands other than his own before completion whereas the work of the latter is begun and finished by his hand alone.

In giving expression to his conception the sculptor frequently works it up from a minute model in the rough which but faintly suggests the portrait that is to be, to sizes larger and more detailed until finally the model for exhibition is finished. This model while expressing all the details may be much smaller than the desired size of the final work—especially if this is to be life size or heroic. For working material the sculptor uses either wax, modeling clay, or some special composition which in addition to being plastic will retain its shape indefinitely and support a very considerable weight. To avoid excessive use of clay but principally to stiffen the figure a skeleton framework is constructed and is known as the armature. Fig 1 shows the armature for the whaleman with poised harpoon—in the New Bedford (Mass.) Whaleman Memorial by B. L. Pratt. A pointing machine consisting of a vertical stand with a multiplying horizontal arm is used to transfer from the accepted model and locate on the armature such points as nose, chin, knees, etc., as this framework is assembled. The clay is then plastered on roughly and afterward shaped to a finish as is shown in the view (Fig 2) of B. L. Pratt's studio, at the left being the figure of "Art" for the Boston Library with the clay roughly plastered on the armature, in front of it being the pointing machine; at the right Mr. Pratt is finishing off the figure of "Science," while in front stands the woman model.

After all finishing touches have been put on the sculptor turns the clay portrait over to the plaster-cast men, who mold about it a shell of plaster of Paris. This shell is then removed by inserting sharp metal pieces about 4 inches square along certain lines depending upon the contour of the figure, and by this means splitting the shell into sections, which enables it to be removed entirely. The shell is then reassembled, and as this progresses a rough framework not unlike the original armature is built up inside of the reassembled shell, excelsior being used to fill any openings in the framework. To prevent the sections pulling apart the entire shell is either bound up securely with wire or is encased in sand. Liquid plaster of Paris is then poured in through an opening at the top and the shell filled—the interior framework serving the same purpose as the armature of the clay model. After removing the shell we have in plaster of Paris a duplicate of the original clay portrait. For proper molding in the bronze foundry it is invariably necessary that the plaster cast consist of from two to twelve or even more parts as the contour of the figure may dictate, that is the head, one or both arms, the base and other parts must be removable so that they may be molded separately. This end is attained in one of two ways. When the plaster cast is made, those members which should be removable are made separately and fitted into a socket cut into the body of the figure, or else at the foundry these members are sawed off, a protrusion is built on the end of each member and made to fit into a socket cut into the body at the point of amputation, thus forming, when assembled, a socket joint. In making the plaster cast of Lincoln (the finished bronze is shown in Fig 11) the left arm, the right arm, the legs, and the head are all removable. In the accompanying illustrations the manner in which the various pieces are separately molded is very clearly shown.

When completed the plaster cast is then delivered to the founders, and here the requirements are so exacting that a combination of skill and patience is necessary at every step. In the foundry the molding is done in dampened sand imported from France, which is not unlike very fine clay in texture and can be packed quite hard. It has the quality of retaining the finest lines of an impression, and will neither lose them nor burn when in contact with molten metal. In the simplest patterns the containing box for the entire mold is made in two halves—an upper and a lower—and is known as a "flask." In the complicated molding of a statue the flask may consist of any number of iron sections held together by clamps, each section supporting some portion of the mold.

Fig 4.—Packing in sand and building up the flask.

After separating the plaster figure into its various component parts they are dusted with soapstone. Starting with the body of the figure or largest portion, it is laid in that position which enables it to be most easily withdrawn from the sand. The molding sand is packed solidly and carried as high as the contour of the figure will permit of easy withdrawing. The surface of the sand is then dusted with plumbago or similar substance to prevent adhesion of the succeeding layer, an additional section of the "flask" put in place, sand again packed in and carried higher on the figure, as shown in Fig 4 and so on until it is entirely covered. It invariably happens that the surface of the figure is so complex that blocks or sections of the sand have to be arranged to move horizontally away from the plaster cast when disassembling the mold. In Fig. 4 the section in front of the face is of this type. Also, the removable sections of the plaster cast are either molded separately, or put in place as the molding of the figure reaches that point, as in Fig 7, where the head of the statue has been added.

In spite of the fact that the sand packs hard and sustains quite a weight it is necessary, when the surface of the mold is of considerable area and irregular in shape, to stiffen it with a framework of iron pieces roughly fitted over the outline of the surface and wired together as shown in Fig. 8. The sand is then packed in place and the form completed as in Fig. 9. Fig. 8 also shows the line of separation between the upper and lower molds.

After the entire plaster cast has been

Fig 5.—Lincoln torso immediately after casting

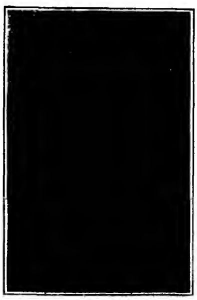


Fig 6.—The torso after superfluous metal has been cut away

covered or molded, it is then necessary to remove every section of the mold in order that the figure may be taken out. Since a solid casting would add both unnecessary weight and cost without in any way adding to its appearance, it is made hollow. To do this the various sections of the mold are reassembled, and as this progresses the space formerly occupied by the figure is packed with sand, forming, when completed, what is termed the "core." The same reason that applies to any other large section of the mold requires that a framework of iron with projecting ends for supporting and handling be built inside the hollow space as shown in Fig. 8. When the "core" is completed the mold is once again taken apart and the "core" removed. It is to be remembered that this entirely filled the space formerly occupied by the plaster cast figure, hence, in order to provide space for the metal the entire surface of the core is shaved away to a depth of about one quarter inch, thereby allowing this amount of space between the core and the mold, as can be distinctly seen in Fig. 9, and it is into this space that the molten metal will flow.

The projecting pieces of the iron framework of the core, which rest upon the mold body, hold the core away from the sides of the mold. These projecting pieces can be seen in Fig. 9, where they serve the additional purpose of handling the core. A vertical hole or passageway is provided starting from the bottom of a reservoir on top of the completed mold and connecting with numerous horizontal runways at different depths which reach various parts of the mold so that the molten metal may reach all points of the mold as soon as possible. Some of these runways can be seen in Fig. 9.

The slightest trace of moisture in the core would become converted into steam and ruin the entire figure when the molten metal came in contact with it, hence, to avoid this the various sections of the core are loaded on a car and carried into an oven where for 24 hours they are kept at a temperature of from 500 deg. to 700 deg. Fahr.

Then for the last time all portions of the mold and core are carefully reassembled, vents are provided for any gases generated, the sections of the "flask" are securely clamped together, a clay lined reservoir is placed on top so that a large amount of metal may be collected before it is allowed to run into the mold, and all is ready for the crucial moment when the powerful crane will lift the big iron bucket holding 2,000 pounds of molten bronze and amid pent up excitement will begin the pouring which will determine whether success or failure will crown the painstaking effort of weeks and months.

Fig. 3 shows the completed flask with reservoir all ready for the pouring. Bronze is an alloy of copper, zinc, and tin. For statuary work the mixture usually consists of 90 per cent of copper, 3 per cent of tin and 7 per cent of zinc although the proportion of tin and zinc is varied to suit conditions. Any of several colors may be given bronze by proper acid treatment, although the natural color gives a better effect, and is generally used. When the metal has cooled sufficiently the sand is broken away from around it, the casting removed, thoroughly washed, and the core removed by washing and cutting. The figure has somewhat of an uncouth appearance, as seen in Fig. 5, in which the projecting parts of the core are seen and the runways are represented by the grapevine effect. All superfluous metal is cut away, an acid bath is given for further cleaning, and the bronze figure now has the appearance seen in Fig. 6. It is now carried to the finishing room, where all of its parts are assembled and permanently fastened in place, any seams being welded together with pneumatic hammers. After a careful inspection and retouching the statue is completed as seen in Fig. 11. It is now ready for its final resting place where it will remain through generations to come a perpetual monument and reminder of the greatness which once helped make history.

By far the greatest number of statues are of army officers; statesmen come next, representatives of the pulpit are sometimes perpetuated in bronze, and away down the list come the navy officers. This may be because the greatest number of our important battles up to and including the civil war were fought by the army, hence the greater number of prominent officers are of the army, or it may be that we have been somewhat slow in perpetuating the memory of our none less valiant and important heroes of the navy.

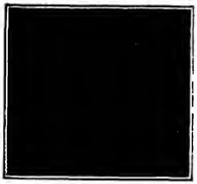


Fig. 7.—The head of Lincoln was put in place as the molding of the figure reached that point

Fig. 8.—Iron framework built in the core. Projecting ends are provided for handling

Fig. 9.—The metal flows in the space between the core and the mold

Fig. 10.—A framework of iron pieces wired together stiffens the mold.

Fig. 11.—The completed statue of Lincoln.

Generating Current at the Mine

THE cost of power for lighting and manufacturing purposes depends generally on the cost of fuel, and the cost of fuel in most cases is determined by the freight rate, or transportation charges from the point of production of the fuel to the center at which the power is required. Successful efforts have been made in Nova Scotia to transport power in the form of electric energy from a colliery to neighboring centers, thus avoiding freight rates or reducing these rates in an amount equal to the loss in electrical transmission plus interest on cost of transmission line.

At Chignecto the central station is located and the district is supplied from this point. The central station as originally equipped contained one 500 kilowatt generator, direct connected with a vertical center crank cross compound engine running at 100 revolutions per minute.

This plant was installed primarily to make a market for some unsalable refuse from the colliery, but the success met with was so marked that additional units were installed. The plant now has a capacity of 1,500 kilowatts and is running with an overload, while plans are being prepared for installing an additional 1,000-kilowatt unit, contracts having been signed for the disposal of the greater part of this additional power.

The power station is located one hundred feet from the bankhead at Chignecto Colliery, and conveyors are so arranged that the fine culm which passes through the screens and crushed refuse which is picked from the screened coal in passing over the cleaning belts, is conveyed directly to overhead storage pockets in the boiler room of the power plant. This fuel contains 23 per cent ash and is fed by gravity into mechanical stokers.

The current is transmitted at 11,000 volts, 3 phase, 60 cycle, and is utilized at Amherst, eight miles from the central station, for general factory purposes and the entire lighting of the city. At Nappan the gypsum quarries operate their derricks and pumps.

Collieries at Joggins Mines, fifteen miles from the central station, are operated mostly by electricity, and the ventilating, pumping and coal cutting machinery are all motor driven.

River Hebert is a thriving farming community, the farmers of which utilize the cheap power available to their own advantage for milking, separating, churning, etc. At the other points touched by the transmission line the power is chiefly used for lighting purposes.

This project has been brought from its small beginning to its present successful state under the direct supervision of G. B. Burchell, a consulting mining engineer of Montreal, Canada.

American University in Siam.—Under the auspices of the American Presbyterian Mission in Northern Siam a university is in process of development at Chieng Mai. It is expected to absorb the Prince Royal's College as the college of arts, in addition to which there will be faculties of sciences, medicine, and theology.

Parabolical Overhead Wiring for Electric Roads

By Owen M de Musnick, C.E., E.E.

THE construction of overhead wiring for electric traction has undergone considerable alterations during the last few years alterations which were to be expected owing to the great extensions of railways and tramways and to the increasing speed The existing construction did not meet the latest requirements, and the chief factors which led to the reconstruction can be considered as the following

I The application of high tension alternating current for traction purposes.

II The necessity of a minimum sag of the conducting wire at high speeds to insure an even contact of the bow (trolley)

III The necessity for suspending the conducting wire in a non rigid manner due to the fact that each rigid point jars the contact bow (trolley) causing it to spark also imparting a trembling motion to the bow (at high speeds) resulting in a series of sparks.

To meet the above requirements it was needful to provide a new means of hanging the conducting wire above the track This was found in the catenary system which permits of the conducting wire being suspended at short intervals and in quite a yielding manner Such a system exists in Holland on the lines Leiden Katwyk Noordwyk and Rotterdam The Hague-Scheveningen The last mentioned line possesses the peculiarity that the influence of the temperature is neutralized by means of weights which give a constant strain to the wire This conducting wire is, of course suspended in a movable manner The parabolical carrying wire, with the parallel wire above the conducting wire, as used on the New York, New Haven and Hartford Railway, are not movable, they are thus subject to the influence of the temperature, lengthening and sagging in hot weather and shortening with increased stress in cold.

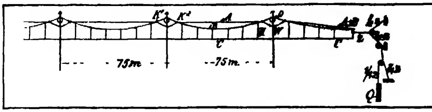
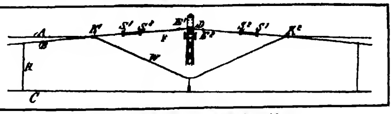


Diagram showing the method of straining the cables so as to prevent sag



Detail of the support at one of the bridges.

To avoid this drawback a system was contrived by the A E G Company by which all wires are made movable

During a number of years they have made different trials along these lines on their experimental railway at Oranienburg, and have succeeded in constructing a system that was adopted by the Prussian State Railways. In 1910 the line Dessau Bitterfeld (steam railroad) was partly equipped with this system, the other part being carried out by the Siemens Schuckert Company (the same system as the Rotterdam The Hague-Scheveningen which was constructed by the same [S. S W] company)

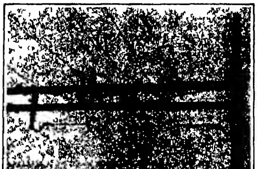
Dessau Bitterfeld is only a trial line, as plans are made to electrify the whole steam road from Magdeburg Leipzig and Halle. This extension will be very important, as the newly constructed part is only 27 miles long and rather too short for making long distance trials at high speeds.

In the accompanying drawings of the A E G system, showing three spans of the overhead line and the method of suspension on a cross girder A is the strain wire, B parabolical suspension wire C conducting wire H vertical suspension wire K_1 and K_2 are clutches, W is the loop formed by A and B passing below the cross girder F is a flexible wire to which the insulators S_1 and S_2 are attached This wire connects the clutch K_1 with K_2 and brings the strain over from one side to the other as the loop W is hanging loosely This flexible wire F is insulated between the insulators S^1 S^2 and rests on the diabolo insulator D on the cross girder Two notches E_1 and E_2 are fixed on each side of the insulator D, which prevent the flexible wire F from moving too far to the right or left under the influence of the temperature Galvanized clutches are used to join the wires together where necessary, as no connection was made by soldering

The insulators are so made that in case one of them breaks the whole system cannot fall as the two wires are looped inside the insulator The strain wire A is provided to assure a regular stretch of the parabolical carrying wire over the whole length from the fixed point to the weights. This strain wire, of course has very little sag The clutches K_1 and K_2 join the strain wire and the parabolical suspension wire at each suspension point on the mast, bringing their strain over on the flexible wire F The loop formed under the cross girder by the two first mentioned wires is necessary in case an after regulation of one of the wires is needful The working of the system is as follows

When the temperature is increasing, the parabolical carrying wire B will expand, thus increasing the sag or in other words decreasing the strain The strain wire A will expand to about the same extent, being made of the same material (galvanized steel cable) its strain will also decrease, and, as it has very little sag, its strain will decrease considerably more than that of the parabolical wire The weights at one end pull with a constant strain, and thus stretch both wires until the strain is balanced, when the drops will be exactly the same as before since for a certain constant strain there is always a certain constant drop. By a decreasing of the temperature an opposite action will take place The same happens to the conducting wire, as it is also connected to the same weights at the end. Near these weights is a lever P to which the three wires are joined, and a flexible wire bringing their stresses over to weights on the mast This lever is necessary because the strain wire and parabolical wire are made of steel, while the conducting wire is made of hard bronze. These have different temperature coefficients, which this lever neutralizes.

To start the building up of the system little hooks are fixed to the masts at *each side of the railroad (about two meters above the ground)* On these hooks provided with wheels the flexible wire F (already fitted complete with the insulators and clutches) is laid, and the strain wire and parabolical wire are fixed to this flexible wire and the required drop of both wires regulated. This drop can be measured by means of a dynamometer (measuring its strain), but it is easier and quite exact enough to find it in the way described below A little wooden post is erected in the middle between the two masts, three movable hands are fitted to this post. The top one is level with the disk on the mast, the other two hands giving the theoretical drop of the two wires. When this is finished complete section from one pair of weights to a new pair (distance of about 1000 meters), is ready The vertical suspension wire can also be fitted The conducting wire is hung on these wires (after being stretched on half its normal strain) When the whole system is ready it is pulled up by block and tackle over the whole length of one section and placed on the diabolo insulator in the center above the track It is always necessary, of course to inspect the system after it has been placed in the proper place, by means of a tower wagon.



Details of one of the bridges, showing method of straining the cables.

Constructing the line at the ground before hoisting in place.

A Comparison Microscope

By Dr Wilhelm Thoerner

THE manifold demands and wishes of workers in every field of scientific and medical research have been met by instrument makers, very successfully, as a rule, by improvements in the mechanical and optical construction of the microscope and its accessories. It is the more remarkable therefore that no instrument has come into general use for the simultaneous observation and direct comparison of two microscopic objects. Such an instrument which may be called a comparison microscope would render very valuable services in a great many scientific investigations. In testing articles of food for example it would often be

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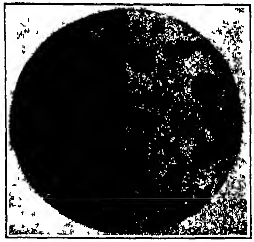


Comparison of two specimens of diatom plankton

A comparison microscope.

The Mono-rail Sled

A NEW type of sled has put in an appearance recently which should delight the heart of every small boy. The object which will first catch his eye is a steering wheel, a real live steering wheel, just like that of an automobile, and it controls a steering runner placed in advance of the two main runners. But even more interesting than that is a fourth runner placed between the main runners. Ordinarily this does not come into play. But after the young coaster is well started down the hill he pulls the steering wheel toward him, depressing this fourth runner, and raising the entire sled upon it so that he continues to glide down hill on two runners, arranged in tandem. This reduces the friction surface, enabling him to outstrip his rivals on the more clumsy type of sled. A certain amount of skill is required to maintain the balance on the center runner, so that the sled will run like a bicycle, and this adds interest and excitement to the sport.

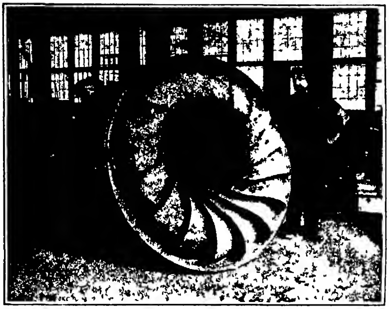
Readers are invited to contribute photographs of novel and curious objects, unique occurrences and ingenious contrivances. Such as are found available will be paid for promptly.

A "mono-rail" coaster

Balanced on tandem runners.

Turbine Casting for the Gatun Power House

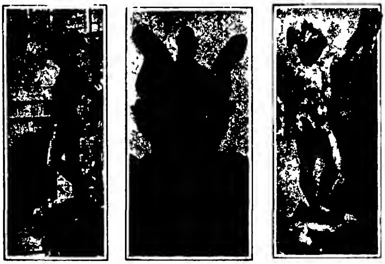
THE accompanying illustration shows one of the three turbine castings recently made at Hartford, Connecticut, for the power house at Gatun, Panama. The turbines will take water from the great lake formed by the Gatun dam and will drive electric generators to supply the power for operating the gates and towing the vessels through the locks and also for lighting the Canal Zone. The turbines will have to develop 4000 horse-power. The castings are made of a composition of copper, tin and zinc in the proportion of 88, 10 and 2. The alloy is required to show a tensile strength of 30,000 pounds, an elastic strength of 15,000 pounds, and 18 per cent elongation. The castings weigh a little under 7,500 pounds. It will readily be appreciated upon examining the illustration that some very intricate dry sand core work was necessary to produce these wheels. The vane cores, of which there were sixteen for each of the three wheels, weighed a little under 700 pounds each, and because of their peculiar shape, they were exceedingly difficult to set.



Intricate turbine casting for the Gatun power house

Benvenuto Cellini's Portrait of Himself

THE rear of the helmet of the famous statue of Perseus at Florence is cleverly designed to represent a face, with a beard formed by the curling hair beneath. Although this face has been known to exist for some time no attention has been paid to it. Recently, however, an antiquarian named Annibale Benedetti discovered the face, and was struck with its marked resemblance to Benvenuto Cellini who made the statue. It is a curious fact that no reference to the portrait is found in the state archives or in any of the descriptions of this piece of work, nor even in Cellini's own memoirs of his masterpiece. The statue was ordered by Cosimo di Medici, and the theory has been put forth that being jealous of the glory that might come to Cellini, he would not permit the sculptor to place his name upon the statue. On the other hand, Cellini being a very vain man, could not give to the world this masterpiece, which took him nine years to complete, without identifying himself with it in some way. Hence, he adopted the daring and novel expedient of actually carving his own likeness upon the statue, so that for all future time there would be no doubt of its authorship.



By courtesy of the Sphere

Portrait of Benvenuto Cellini, discovered on the helmet of his famous statue of Perseus.

The Sleigh of the Desert

A CORPORAL in the French army in North Africa has devised a peculiar machine particularly adapted for travel over the sand wastes of the Sahara. The machine is a cross between an automobile and an aeroplane, and has been dubbed the "sleigh of the desert." The construction is very light indeed. It is mounted on broad tired pneumatic wheels, but is driven by an aeroplane propeller. It is so light and its bearing surface is so great that it will ride over the sands without sinking, leaping over light depressions and climbing the steepest sand dunes. There is a decided advantage in using an air propeller, for then the drive of the machine is independent of its traction. In the loose sand of the desert it would be rather difficult to propel a machine after the manner of an automobile. The accompanying photograph, which is published by courtesy of *L'Illustration*, shows the odd machine upon its arrival at Toujourt having carried Gen. Baillond over a distance of about 130 miles. The peculiar vehicle is named La Souterelle or the grass-hopper because of its peculiar hopping flight over the irregularities of the desert.

The "grass-hopper" coach of the Sahara.

Fish Killed by Frost and Storms

IN *Symons's Meteorological Magazine* the Rev. D. C. Bates, dominion meteorologist of New Zealand, tells of some curious effects of atmospheric disturbances on fish. A deep-sea species known as the frost fish (*Lepidopus caudatus*) is found lying dead on the shores of the South Island of New Zealand during and after severe cold weather. It is a long ribbon-like silvery fish of delicious flavor and men scour the sands at night to find it. These fish rise from very great depths and apparently are killed by the bursting of their air bladders rather than by the cold; yet their coming to the surface seems to be connected with the weather, especially with anticyclonic conditions.

After severe storms the coasts of New Zealand are often strewn with tons of dead fish of many species. A correspondent of the author writes in regard to such an occurrence at Island Bay, Wellington, on July 18th, 1912: "This is not the first time, nor the tenth time, that fish have been landed on the shores of Cook Strait in precisely the same fashion, in every case subsequent to a storm. Therefore we must look for the cause in the storms, unless it is that storms only produce what we call fumes by stirring up the bottom of the sea. Immediately offshore we have comparatively deep sea, inhabited by fishes which are not usually met on the immediate coast line. If from any cause during a high storm deep-sea fishes lug close to the land, then it only requires a very heavy sea in which waves strike the bottom to involve the fish, rush them ashore, and kill them by hundreds."

After the storm of July 18th mentioned above, great quantities of the dead fish—ling, hapuka, hake, etc.—were gathered and brought into Wellington. On another occasion some thirty years ago the beach at Okarito on the South Island was strewn for seventy miles with fish of all sorts and sizes.

How to Wax Old Unpolished Floors

TO wax old floors that were never polished the following method is good. The floors should first be washed thoroughly and then when dry coated with some floor oil such as linseed oil. This should be at once rubbed with sawdust, which removes all surplus oil and polishes the floor. After this any wax may be used according to its directions, and then after a weighted brush is used the old floors will be as slick as new oaken floors. After this they should only be washed with gasoline.

A Bill Providing for a New Patent Office

ON January 17th, 1913, Mr. Bulkley introduced a bill providing for the construction of a Patent Office of the United States. The sum of $4,000,000 is to be appropriated out of any money in the Treasury not otherwise appropriated for the erection of a fireproof building. It is very doubtful if the bill will be taken up during the present session. Everyone at all familiar with present conditions in the Patent Office will recognize the necessity of the new building.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Recent Improvements in Machine Tools—II

[IT has often been said, and rightly so that the perfection to which metal working has attained is one of the miracles of modern times In many factories throughout the country the various pieces are turned milled, sawed, planed or ground in such quantities at such speeds and with such unfailing accuracy as to command the admiration of the observer Yet in spite of this perfection there always seems to be room for further improvement This is the second of a series of brief articles on recent improvements that have been made in machine tools EDITOR.]

IN bevel gear cutting machines it has long been the custom to tilt the cutter carriage to the proper angular position desired

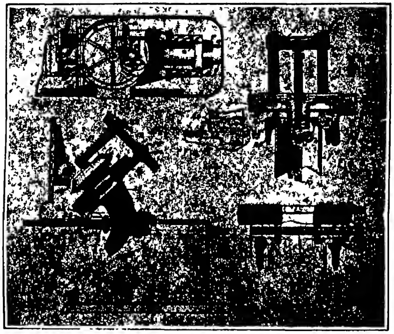
The disadvantage of this proceeding has been that such a structure lacked the proper rigidity for heavy cutting—a disadvantage which has been particularly noticeable since the advent of high speed steel cutters. This lack of rigidity is due to the mounting of the reciprocating cutter carriage upon the angularly adjustable slide and the circuitous route by which the motion is transmitted from the primary mover to the cutter spindle and feed screw

A recent patent granted to W F Zimmerman of Newark, N J, shows a marked commercial advance in the art of cutting bevel gears. Instead of tilting the cutter carriage, the patentee provides a work table which is capable of being tilted to the proper angle This table is so constructed that the strains imparted thereto by the cutter are taken by a base of rigid construction

The advantages of this device are at once apparent In the usual constructions where the cutter is adjusted, there are three sliding surfaces necessary—two for the cutter and one for the work table But by adjusting the work table, only two sliding surfaces are required—one for the cutter to reciprocate thereon and one for the work table Then too a less complicated drive necessary to rotate and feed the cutter is required It also eliminates the additional means required to control the reciprocating movements of the cutter slide and the indexing of the blank the index drive being practically the same as usually found in ordinary spur gear cutting machines.

As seen in the figures, an adjustable slide 2 is provided with clamps 25, operated by handles 26 so that the slide 2 can be firmly secured to the frame 1 Hinged to one end of the slide 2 is a tilting bed 3 having rotatably mounted therein a work table 4. A work arbor 6 is secured in this work table by means of a differential nut 5 and centers the bevel gear blank 7 Depending from the center of the tilting bed 3 is a segmental arm 9 having a worm wheel segment 10 This arm is secured to the slide 2 by means of a bolt 56, its outer periphery being rigidly clamped by means of a clamp 57 to a finished portion within the aperture of slide 2, through which the arm passes

The tilting bed 3 and the bevel gear blank 7 are adjusted to the proper angular position by the worm 11, rotatably mounted in the slide 2, engaging the worm wheel segment 10 On one end of the worm 11 is a helical gear 12, held in position by means of a nut 13 which engages with a helical gear 14 This gear 14 is slidably keyed upon and rotates with the splined segment adjusting shaft 15, and is held between the bearings 16 in the slide 2 The forward end of the segment adjusting shaft 15 projects beyond the frame 1 and is provided with a graduated dial 17 and a square end 18 to receive a crank handle The ratio of the worm wheel segment 10 and worm wheel 11 and helical gears 13 and 14 is such that for each turn of the segment adjusting shaft 15, the bed 3 is adjusted one degree indicated by the dial 17 graduated to read in minutes.



In this bevel gear cutting machine, a distinct improvement has been effected in machine tools. Instead of tilting the cutter carriage, the patentee provides a work table which is capable of being tilted to the proper angle.

As seen in Fig 5, a graduated segment 10, reading in degrees, is secured to the bed 3 in connection with a vernier scale 20 reading in tenths of a degree to indicate the exact angular position of the work at all times.

The work table 4 is rotatably mounted in the bed 3 and is provided with T slots 21, to secure the blank to the table The index wheel 22, which rotates the work, is arranged upon the periphery of the work table 4. The work table 4 is supported near the outer periphery by a circular bearing 23, arranged in the bed 3, and is held thereto by a circular plate 24 secured to the bed 3. This plate 24 is provided with a circular groove to form a channel for the cuttings and the lubricant to lead them into the base of the main frame. The plate 24 also serves as a guard to protect the index wheel from chips and dust.

The index wheel 22 is rotated by an index worm 27, rotatably mounted in an adjustable bearing 28 on the bed 3. The bearing 28 is adjusted toward or away from the index wheel 22 by means of the handle 30 A stop-screw 31 is provided in the bearing 28 to gage the depth of engagement of the worm 27 and wheel 22. A helical gear 32, engaging with a second helical gear 33, is mounted on one end of the index worm 27 The gear 33 is loosely mounted upon the hinged shaft 34, passing through the lugs 35 and 36, and the lug 37 between the lugs 35 and 36 is supported by the ways of the main frame 1 The helical gear 34 is rotated by a helical gear 38 rotatably mounted in a bearing of the slide 2. This arrangement of helical gears provides for transmitting a rotary motion from the helical gear 38 to the index worm 27, independent of the angular position of the worm 27, and for the disengagement of the index worm 27 from the wheel 22 in all the angular positions of the worm 27

The cutter carriage 48 with rotary cutter 49 is reciprocated vertically by well known means.

When the work has been adjusted to the proper angle, the slide 2 is adjusted longitudinally toward the cutter carriage 48 by means of the screw 46, the end 47 of which is adapted to receive a crank handle The amount of adjustment is indicated by the dial 50 graduated to read in thousandths of an inch After the work is secured to the mandrel 6 by means of the nut 8, the projecting end of the mandrel 6 is supported by a triangular arm 51, slidably arranged upon two posts 52 and clamped thereto by means of the handles 53. The posts 52 are slidably mounted in the bearings 54, provided in the bed 3, and are clamped to the bed 3 by means of the bolts 55.

(To be continued)

By courtesy of Judge

Shall we permit the Oldfield bill to become a law and destroy this monument?

The Oldfield Bill Cartooned

THE accompanying cartoon, reproduced by courtesy of *Judge* from the columns of that weekly, tells its own story Readers of the SCIENTIFIC AMERICAN who have followed the attempt to pass a measure which cannot but have a destructive effect upon our patent system, and which must inevitably discourage invention will appreciate the graphic truth of the cartoon *Judge's* title for the picture evidently inspired by a resolution addressed by the Inventors' Guild of New York city to President Taft, read

Invention has contributed the greatest blessings of civilization and for America has laid the ground work of our wonderful industrial prosperity The American patent law, by its liberality to inventors, has fostered the inventive faculty and made us the foremost inventive people. If we value future progress and continued prosperity, we should change our patent laws only after the most scientific and searching study, and only upon the most conclusive grounds."

A Non-refillable Bottle.—In patent No. 1,046,757, to Charles C Fine, assignor of one half to Jacob W Fine, both of Nanticoke, Pa., is shown a bottle in which there is provided a longitudinal passage parallel with the neck outlet and opposite said passage is another longitudinal passage communicating with it through a lateral opening and a second longitudinal passage contains a ball which controls communication with the interior of the bottle to prevent refilling and may be unseated to permit the contents of the bottle to be dispensed.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

BELT BUCKLE.—M GREENFELD, care of Ralph B Ittelson 170 Broadway New York N Y The invention relates to improvements in buckles and particularly to belt buckles and has for an object the provision of an improved catch or interlocking structure adapted to be readily engaged and disengaged but firmly held in place when engaged.

GARMENT STIFFENER.—ROXANNA A HAMPTON 23 W 24th St Manhattan N Y N Y This stiffener is more especially designed for stiffening the yokes of ladies dresses and waists such as open along the back and arranged for convenient insertion in the yokes and sufficiently pliable to readily conform to the shape of the wearer with a view to give the desired stiffness to the yoke without rendering the garment uncomfortable

Of Interest to Farmers.

YOKE.—J LLORET and J GIMENEZ Calle Colon No 2 Habana Cuba For the purpose of enabling an animal to more easily carry a load attached to a yoke use is made of a main stem adapted to turnably engage the shaft or tongue of a vehicle a main bearing body mounted to swing on the main stem auxiliary bearings on the main bearing body and head bows mounted to swing on the auxiliary bearings

Of General Interest

FENCE POST.—R F CARPENTER, Bandon Ore The invention provides a one piece post which may be driven directly into the ground and which does not require tamping Also provides a post with means for holding the fence wires securely but in such a manner that they may be released from the post when desirable

PLANT PROTECTOR.—W G COWART Nocatee Fla This protector is formed of fixed and movable parts consisting of panels and supporting stakes A series of oblong panels is supported in fixed position inclined, say 30 degrees to the vertical by means of stakes set in the ground and inclined in opposite directions, their upper ends or heads being connected with the top or ridge bars of the panels, the latter being placed near and parallel to the row of plants needing protection Another portion of the protector is composed of a series of adjustable panels, and a third series may be employed and adapted to extend over the plants, or fully folded back for exposing the plants Mr Cowart has invented another protector formed of two oblong panels secured together rigidly at an angle to each other whereby the device is adapted to be applied over and protect plants and with means for supporting the protector when turned on its side so that it is held constantly in position for replacement over the plants.

COMPOSITION OF MATTER TO BE USED AS A FLEXIBLE COVERING.—F M GUSCH BAUER care of W O Fahl Am Flexible Slate & Covering Co Milwaukee Wis This invention relates to a covering material to serve as a substitute for slates tiles and other forms of water and acid proof coverings and linings An object of the inventor is to provide a flexible covering impervious to acids and alkalis, of a water proof and air proof material for use as a roof covering or in any locality where it is desired

DEVELOPING TUBE.—J F WALLACE Varna, Ill The invention provides a means whereby photographic films may be developed in daylight The device is convenient for carrying without liability of injury Developing means is provided that may be conveniently manipulated and which will insure that the film is effectively subjected to the developing fluid

FLEXIBLE SLED.—J C MINIER Ridgway Pa. An object here is to provide a device which is more easily manipulated than the ordinary flexible sled in that it has greater leverage upon the flexible runners. It costs no more than the ordinary sled for rendering the present flexible sled more susceptible to guiding influences.

LIFTER AND CONVEYER FOR INVALID BEDS.—J GERMAN Richland Center Wis This invention relates more particularly to the combination of a bed an auxiliary support adapted to be positioned upon the bed to receive the patient and means for moving the support in a plurality of directions and for removing it entirely from the bed to a point remote from the same the means serving to hold the support in different operative positions when it is removed from the bed

DRY CARTON.—A TAYLOR 15 E 42nd St New York N Y Among the principal objects which the present invention has in view are to provide means for preventing injury to articles by moisture while in storage or transportation and to provide a simple efficient and economical means for deleting the moisture from cartons or other such devices. The cartons may be used for holding tennis balls, cigars, candies, and a wide variety of other materials.

DRINKING CUP.—C. A BRYANT, Passaic N J This cup is made of paraffine paper in

the form of the frustum of a cone and is made of a single sheet of paper doubled up and having the sides connected with each other the bottom being flat and upon which fold ears fastened in place by a separate strip glued thereto and overlapping the ears.

LOCKET—J NEDERLAND, 276 Fifth Ave., Brooklyn, N Y To provide a hinged frame shaped to prevent buckling when the locket is made of light material to provide a hinged construction shaped to the contour of the locket, to provide a frame for the locket having the glass and picture frame formed integrally therewith to form an interior snap integrally constructed from one portion of the frame to engage the other portion, such are the principal objects of Mr Nederland's invention

CHANGE LETTER SIGN—W ELLISON Roosevelt, N Y The invention consists in securing between overlaying areas of open mesh wire gauze opaque letters assembled and arranged to form a reading sign the contrast between the opacity of the letters and the transparency of the gauze imparting an aerial and unsupported appearance to the sign. A simple means is provided for binding the over layed gauze on the interposed letters.

SAFETY BOTTLE HOLDER.—T ZARRANAS care of A. M Marters, 120 Grand St. Brooklyn, N Y This holder is arranged to permit the milkman readily to place a bottle of milk therein and prevent unauthorised persons from removing the bottle surreptitiously from the holder The holder is provided with a sliding cover which may readily be opened by the milkman but which is locked in closed position by the introduction of the bottle

DESK PAD—E. OLDENBUSCH, care of Kronheimer & Oldenbusch, 380 Butler St., Brooklyn N Y The present invention relates to desk pads and more particularly to a corner plate for desk pads so constructed that in addition to performing its usual functions of confining a corner of a sheet of blotting paper it may also be used as a receptacle for small cards and other articles.

BURIAL VAULT—J BERMEL, 2210 Metropolitan Ave Middle Village L. I N Y The object of the present invention which relates to a previous patent No. 983,804 is to provide an improved vault arranged to accommodate one or a plurality of bodies and to protect the latter from vermin by providing hermetically sealed catacombs or compartments, one for each body these compartments being practically airtight and waterproof

COMBINED TABLE AND MAP RACK—K W SCHWARZ, 615 Center St. Little Rock, Ark The invention consists of a table with a box supported under the table top. In the box is a rotating cylindrical casing provided with a number of rollers for accommodating any desired number of maps. The maps may be drawn out of the cylinder, and through a slot in the table top, and spread out upon the table

BLOTTER HOLDER.—J L. HAYES care of Lee Hayes, P O Box 1375 Butte Mont The holder is made of resilient material with flanges at its ends for holding the blotter against the body of the holder and with the central portion of the body formed in a spring loop which serves as a handle and also as means for holding the flanges yieldingly in position

TRUSS—J T HAILE, Utopia, Tex The aim is to provide a truss, arranged to permit in placing the pad into any desired position securely holding it therein to prevent irritation of the body and to render the pad pliable and at the same time maintain the uniform pressure on the afflicted part

STREET SIGN—J STRACHAN 384 36th St. Brooklyn, N Y The principal object here is to provide a sign having means thereon whereby it may be secured in position on the sidewalk, the construction and arrangement being such that portions thereof are protected from injury by the wheels of passing vehicles.

NAIL STRIPPER—C F SMITH 412 E. 16th St Los Angeles, Cal In this device different sized nails may be inserted, the nails automatically alining themselves so that they may be withdrawn heads up. This is obtained by positioning within a suitable casing an inclined hopper from which the nails are fed in grooved tracks, from which they may be readily withdrawn in assembled order

Hardware and Tools.

HANDTOOL.—B MORGAN Newport, R. I Mr Morgan's improved handtool may be used as a clamp or as a spreader and stretcher for coil springs or as a valve lifter. It consists of a screw rod bearing two jaws, one fixed and the other movable upon the rod, a lever and ratchet mechanism being provided for this purpose

TELESCOPING POCKET RULE.—F C GREATHEAD, 1835 Weton St. (rear) Denver Colo. This telescoping pocket rule is of simple construction and arranged to hold compactly and yet may be extended or folded with the use of but one hand. It is made of a number of telescoping sections provided with enlarged rear portions having sliding engagement with the following sections and having a contracted front end for the enlarged rear end of a preceding section to abut against.

PIPE [illegible] Beacon St., Boston, Mass. [illegible]

INQUIRY COLUMN

Inquiry No. 9287 Wanted to buy a machine which will reduce cobs to meal—not a machine for shredding the cobs, but a machine that will pulverize them.

Inquiry No. 9288. Wanted the names and addresses of concerns that can cast steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9289 Wanted substance melting at 225° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oily or fatty vapor

Inquiry No. 9290 Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes, namely, to fold up bills and insert them with silver coins in a pay envelope of the usual size.

Inquiry No. [illegible] Want to buy machinery for [illegible]

Inquiry No. [illegible] Wanted a [illegible]

Inquiry No. 9294. Wanted the names and addresses of manufacturers of waterproof cloth, also samples of such cloth.

Inquiry No. [illegible] Wanted to buy [illegible] [illegible]

is an improvement in the type comprising a fixed jaw and a moveable or sliding jaw the latter being formed integral with the shank which slides in the handle and is provided with a screw thread to which a portion of the handle constructed as a nut is applied for the purpose of adjusting the movable jaw The fixed jaw has an inwardly inclined face and the adjustable jaw is formed with a V shaped toothed biting surface.

Heating and Lighting.

GAS GENERATOR.—M Davidson 46 Rue de Chateaudun, Paris, France. In the present patent the invention has reference to improvements in gas generators and has for its object the provision of a gas generator the vat of which is so suspended as to keep the approaches of the hearth completely clear

FLUE CLEANER.—G C. French, Eldora, Iowa. This invention refers to cleaners for freeing the flues of boilers and other apparatus from accumulations of soot, scale and the like and has reference more particularly to a flue cleaner which comprises an elongated flexible body having an adjustable scraper mounted thereon

PORTABLE CREMATING CLOSET AND GARBAGE DESTRUCTOR.—N Frost care of Am Foundry & Furnace Co., Bloomington Ill This apparatus is more especially designed for use in camps and other places having no sewers, and arranged to incinerate excreta and to evaporate urine etc and to destroy garbage or other loose material and to utilize the loose material as fuel for incinerating purposes.

OIL BURNER.—T J Langston Johnston, S C. The principal object of the present invention is to provide a device by means of which oil such as kerosene may be vaporized and burned in a gaseous state A further object of the invention is to provide a simple form of burner to be used in cooking and heating stoves, which is made up of pipes, elbows, T's, etc, of standard sizes and quality

Household Utilities.

DUMB WAITER GUIDE.—W F King 46 Stuyvesant Place New Brighton, N Y, N Y This guide is made entirely of metal so as to comply with municipal ordinances relative to the exclusion of combustible materials from elevator or dumb waiter shafts Means provide for anchoring the guides to the wall or walls whereby the guides may be easily adjusted to make them adapted for different constructions of elevator cars, and easier of installation than those now in common use

Machines and Mechanical Devices.

FIRST COMBING MACHINE OF CARDING ENGINES.—T F Poiret, 40 Rue St. Denis, Paris, France. This invention relates to improvements in automatic unraveling conveyers for a wool-carding engine in which the wool to be carded, being placed in a trough is seized by a toothed drum rotating in said trough and afterward evened upon the drum by a saw toothed comb having an oscillating motion tangent to the drum and acting alternately

FRUIT DRIER.—L. R. Skinner, Dunedin Fla This particular machine is adapted for drying oranges, grapefruit and the like subsequent to the operation of washing them. In the machine small streams of air are forced directly upon the fruit which is rotated so as to bring all parts into direct contact with the moving streams of air

BENDING MACHINE.—F T Root and G A Fenton care of Defiance Machine Works, Defiance Ohio. The present invention is an improvement on patent No. 603,026. Its object is to provide an improved wood bending machine arranged to insure positive movement on the bending arms to cause the timber to hug the form snugly and thus produce accurate bending of the timber

TAPPING MACHINE.—M. J Ford 125 10th St Scranton Pa The machine provides a means for quickly forcing a tap into a hole and as quickly unscrewing it. It consists of a casing provided with a suitable handle, in which is a step-down gearing connecting a motor with the handle that receives the tapper member in which the tap is mounted. The motor is preferably of the pneumatic type

MILL.—I C. Landes and M. C. Landes care of Landes Mill Works, Yerkes, Pa. The purpose here is to provide a mill in which the material entering the mill is caught by an auger having openings, the material being caught by the blade on the auger, and being forced by the auger into a recess formed by a disk and the casing of the mill, where the rotation of the material is retarded by radial stops, while the blades of the auger act on the middlings to break it up, so that it may be bolted through bolting cloth

OPERATING MECHANISM FOR FLUSHING DEVICES.—O Kreter and G B. Kreter, care of Kreter & Son, 616½ Market St., San Antonio, Texas. This invention relates more particularly to the combination of an actuating member adapted to be operatively associated with a flushing device and with water closets and the like, an operating member tending to maintain a normal position and adapted to be actuated by a closet seat, and a dog operable by the seat and adapted to engage said operating member during a predetermined [illegible]

PNEUMATIC ACTION.—A Alter 500 E. 83rd St. Manhattan, N Y N Y The invention pertains to piano players, player pianos and like instruments having pneumatics, and the object is to provide pneumatic action which is exceedingly sensitive and insures a quick deflating and refilling of the pneumatic and thus allows sounding of the same note in quick succession

GATE CONTROLLING MEANS.—A F Giles, 632 Brinker Ave Latrobe Pa This invention provides for automatically locking the gate when the cage has been brought to the proper position at a landing automatically holding the gate open so long as the cage remains in the predetermined position and for automatically releasing the gate and causing it to close when the cage is moved above or below the landing or other predetermined point

LOGGING JACK.—C D Moore Kirkland, Wash In this jack a rack bar is raised by means of a pivoted lever provided with a pawl adapted to engage a rotatable ratchet connected with the said rack bar through the medium of a pinion The objects of the invention are to simplify the construction, reduce the cost, lessen the friction, and increase power, speed and efficiency of the jack

CROWN PRINTING DEVICE.—W Jackson care of the Robert Graves Co 3rd Ave & 35th St Brooklyn, N Y In this invention use is made of an impression cylinder and a crown printing roll mounted to rotate in unison with the said cylinder and having periodical bodily movement toward and from the peripheral face of the impression cylinder to provide the wall paper passing round the said cylinder with crown imprints at desired intervals.

Railways and Their Accessories.

CAR DOOR.—S Walters 317 Morrison St Warren Pa The principal object here is to provide a door embodying means whereby the door when in closed position will lie flush with the side of the cars, means being provided for moving the door preparatory to opening it, suitable rails being provided whereby the door may be rolled to uncover the opening the door moving into a position remote from the side of the door

Pertaining to Vehicles.

BUGGY SHAFT SUPPORT.—R M Purdue, Franklin Ky An attachment for buggies is here provided which is adapted to support shafts or thills in raised position when the vehicle is not in use The device consists of a spring actuated hook fixed to the buggy front and adapted to engage with the cross bar on the shaft.

BRAKE MECHANISM FOR AUTOMOBILES.—R. S Pelton Monticello New York This invention provides separate and independent brakes for the rear driving wheels of the automobile so that either wheel may be locked when it is desired to prevent its slipping in the mud the propulsive effect of the motor being in such case applied to the other wheel resting on dry ground

SHOCK ABSORBER.—W H Ball, 272 W 139th St Manhattan N Y N Y This inventor provides means for checking the free operation of the carrying springs of a vehicle when acted upon by the irregularities of the road, provides for simplifying and economizing the construction and provides an absorber shaped to vary the operation in accordance with the degree of vibration

VEHICLE TIRE.—H L Beaver care of J S Schuster, 288 E 157th St., N Y, N Y This invention relates to vehicle tires such as shown in Letters Patent No 371 945 formerly filed by Mr Hittner The present invention provides a tire for wheels of automobiles and other vehicles and arranged to provide the desired cushioning effect, without use of inflatable tubes, to render the tire puncture-proof and to permit of quickly making repairs when necessary

Note.—Copies of any of these patents will be furnished by the Scientific American for ten cents each Please state the name of the patentee, title of the invention, and date of this paper

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The Evolution of Worlds

The Work of Sir George Howard Darwin

By John W. N. Sullivan

THE great conceptions of science have always possessed a more than scientific interest. The Copernican theory in astronomy important as it was from the purely scientific point of view, was of still greater importance as a powerful factor in freeing men's minds from that local and narrow view which considered our planet to be the center of the universe and all the starry hosts of heaven to be somewhat in the nature of pleasing ornaments. The Newtonian theory of gravitation also by showing that one great law reigned throughout the solar system gave a unity to nature of the greatest philosophical and religious significance. And in our own time the theory of evolution introduced as a hypothesis in the realm of biology has influenced our conceptions in nearly every branch of knowledge.

One of the most fascinating illustrations of the general principle of evolution is found in the history of the origin and growth of the members of our solar system. It is fitting that the son of the man who told us so much about the origin of species should be the man to tell us so much about the origin of worlds.

George Howard Darwin the second son of Charles Darwin was born at Down in 1845 and died at Cambridge on December 7th 1912. As a student he gained high mathematical honors at Cambridge that breeding place of great mathematicians, and became Plumian professor of astronomy in the University in 1883. His interests embraced economic and political science besides purely mathematical subjects and he was in fact called to the bar in 1874. Considerations of health however led him to return to Cambridge. His greatest achievements have grown out of his interest in the theory of the tides. Newton was the first to give anything like a scientific explanation of their occurrence and he gave a satisfactory account of the main features of the phenomena. The principles of further developments were laid down by Laplace and were afterward applied in a magnificent manner by Kelvin. It was at this point that George Darwin took up the subject and the patience and tenacity he showed in performing vast and intricate numerical computations reminds one singularly of the same qualities shown by his father in collecting data for his theory of biological evolution. The main lines of tidal theory are well known. Most people are aware of the fact that the attraction of the moon and of the sun causes a kind of hump in the sea which travels round the earth owing to its rotation. The moon is the more powerful agent and the two humps it produces (one on the side of the earth nearest the moon and the other on the opposite side) travel round the earth in about 24 hours 50 minutes whereas the humps caused by the sun travel round in 24 hours. When the lunar and solar tides coincide we have spring tides and when they act against one another we have neap tides. Such in brief is the main outline of the subject, but to pursue it into its details requires a vast amount of complicated mathematical analysis. But apart from the details of the actual tides experienced on our earth they have a significance of far greater interest than themselves. They throw light on the origin of some members of our solar system. The tides do work—sometimes useful work, as in scooping out convenient landing places for our great ships and sometimes useless work. But in any case the dissipation of energy is involved and as we know that energy cannot be created the question arises where does it come from? The earth possesses a large store of energy in virtue of its revolution and ultimately the energy daily expended by the tides must come from that. But the earth's store of energy, though great, is not infinite and it must follow that the earth's store is decreasing, in other words, that the earth is slowing down in its revolutions. Of course this slowing down is excessively minute nevertheless it exists and it follows that in ages long past the earth must have been rotating appreciably faster than at present. As we trace things back farther and farther we find the earth rotating faster and faster and so the length of the day becoming continually less. Is there any limit to this process? The answer is that there is a certain critical velocity at which the materials composing the earth would be unable to resist the strain consequent on the velocity of rotation and the earth would fly in pieces. This critical velocity has been calculated and it appears that the length of a day in those inconceivably distant ages would be between three and four hours.

The length of our present day of twenty four hours we have attributed to the action of the moon. The tides caused by the moon act as a kind of brake on the earth. But Newton's third law of motion teaches us that every action has its equal and opposite reaction. What has been the reaction of the earth on the moon? *The earth has driven the moon farther and farther away.* The principle of the conservation of the moment of momentum teaches us that the momentum lost in one part of the system must be gained in another and therefore as the earth slows down the orbit of the moon becomes larger. The length of the day is increasing, and so is the length of the month. In remote ages when the earth was rotating much faster than it is now the moon was much nearer than it is now. The relation between the velocity of rotation of the earth and the distance of the moon has been calculated and we reach the enormously interesting result that at the time when the earth was rotating with the critical velocity of between three and four hours the moon was at such a distance that it was just grazing the surface of our planet. This cannot be a mere coincidence. We are irresistibly impelled to the conclusion that we have reached the time of the birth of the moon. In that remote age the earth *did* fly in pieces. It broke up into two great lumps and one of those lumps was the moon. At that time the length of the day and the length of the month were equal. Since then the earth has been driving the moon away and the moon has been slowing down the earth. But the ratio of the month to the day has not been steadily increasing. It is true that it increased to a certain point but then it started to decrease. Long before the dawn of history perhaps before the appearance of men on this planet there were more days in the month than there are now. At the period of maximum there were twenty nine days in the month or in other words the earth completed twenty nine revolutions on its axis while the moon completed one revolution round the earth. Since then the ratio of the month to the day has become steadily less. This process will only cease when the tides cease to act as a brake. This can only be when the earth rotates in the same time as the moon so that once again the day will be as long as the month. So far as the earth moon system is concerned this condition will be dynamically stable. Having once been attained it will never alter. It has already been attained by the moon itself. It is well known that we only see one side of the moon which means that the moon rotates on its axis in the same time in which it rotates round the earth. The earth-caused tides on the moon have done their work. If in that far distant future any considerable part of the earth is still fluid, the solar tides may cause a still greater increase in the length of the day and it may be that instead of the day being equal to the month, finality will be reached with a day longer than the month. This is what seems to have happened with the planet Mars.

Mars is probably older than the earth, and it is considerably smaller, so that

tidal action should have already accomplished there what still lies in the distant future for our earth. Now one of the most astonishing things attending the discovery of the satellites of Mars in 1877 is the fact that the interior satellite Phobos revolves around Mars in 7 hours 40 minutes, while Mars revolves on its axis in 24 hours 37 minutes. There can be little doubt that this result is a direct consequence of the action of the solar tides on Mars, and is, as it were, an experimental verification of the mathematical predictions sketched above.

This necessarily brief and imperfect account of some of the most important work of the late George Darwin may serve to give the reader some idea of the magnitude of the problems which engrossed him and of the far reaching importance of the results to which his genius led him.

His results aroused the interest of many other mathematicians, particularly the late Henri Poincaré, and there is no fear but that the subject will continue to receive the attention its importance warrants, although the inspiration to conceive, the stubborn patience to grapple with all difficulties, and the magnificent ability to overcome them is hardly likely to be greater in his successors than it was in the great Englishman who has so lately vanished forever from among us.

A $100,000 Prize for a Gasoline Substitute

By Stanley Petman, M. E.

FOR years it has been prognosticated that the supply of gasoline eventually must prove inadequate to keep step with the demand. Lately, developments would seem to indicate that there has been more than a grain of truth and true prophecy in the forecast, for with the production of motor cars steadily increasing at a rate that in not a few circles is viewed as alarming, the best efforts of the oil producers apparently are unavailing to meet the requirements.

At least the price of fuel for automobiles steadily has soared—in a little more than one year it has gone up 88.8 per cent in America by leaps and bounds—and whether or not the true reason for the rise in price is good old "supply and demand," as so glibly is set forth by the oil barons themselves, the ultimate result is the same, i. e., the automobile owner must bear the burden.

That such conditions could not be allowed to endure long has been evident, for no man will stand idly by with folded hands when there is the ghost of a chance of ameliorating affairs. But the amelioration naturally will require the expenditure of much money and the devotion of much time to be effected. Within the past few weeks, the British Society of Motor Manufacturers and Traders has offered a prize of $100,000 for a fuel which may be used instead of petrol, as gasoline is styled abroad. For some time, foreign motorists have used benzol, which is a coal tar derivative, as a substitute, but realization of its value has resulted in its price being boosted almost to that of gasoline. Added to which it is procurable only in limited quantities as compared with the supply of gasoline.

All of which emphasizes very strongly the necessity for some sort of concerted action to relieve the situation, which rapidly is reaching the state where it is unbearable to motorists, who carry the heavy end of the load, and to every one else who uses internal combustion engines operating on the lighter distillates of petroleum.

At last, however, the International Association of Recognised Automobile Clubs, the membership of which is composed of representatives from the most influential automobile clubs throughout the world, has seen the light of necessity and has stepped into the breach by offering to finance the donation of a cash prize of $100,000 for the best all around fuel other than "petrol," or gasoline, which will satisfactorily take the place of the petroleum product.

The decision to offer the prize was made at the last meeting of the association,

which was held last month in Paris when it was arranged that each of the big clubs in the organization representing France Great Britain, America Germany Belgium Italy Sweden Denmark Austria Holland Hungary Russia Switzerland Roumania and Egypt, should subscribe its portion to a general fund which shall constitute the prize. A special organization committee already has been named to go ahead with the work. Baron de Kuylen de Nyvelt is chairman and makes his headquarters at the offices of the International Association of Recognized Automobile Clubs in Paris.

As regards the contest itself the restrictions are very simple. The fuel must be suitable for existing internal combustion engines. It must be less expensive of course. It must be readily procurable. It must be of such nature that it cannot be cornered by trusts national or international. That is all.

Prior to the formal announcement of the conditions in detail which are now in course of preparation in the hands of the committee and which in sum and substance will be as given above assurances will be obtained from the various governments that the new fuel will be untaxed or at least that it will be taxed only very moderately.

A Comparison Microscope

(Concluded from page 15)

highly advantageous to be able to compare directly under the microscope a specimen of the suspected article with a specimen of the same foodstuff of unquestioned purity.

In many other investigations in botany zoology mineralogy bacteriology and especially in medicine the comparison microscope would prove equally valuable.

An instrument of this character which can be adjusted to show two objects in the two halves of its field of view is illustrated in the accompanying photograph. It consists essentially of two microscope objectives optically connected with a single eye-piece by means of four total reflecting prisms two placed under the eye piece and one at the top of each objective tube.

The pinion ... serves for the rough and the micrometer screw *B* for the fine focusing of the microscope any difference in the thickness of the objects or their carriers being compensated by means of the screws *C C*.

The two prisms beneath the eye piece are mounted on a slider which can be moved to right or left by turning the pinion *D* so that the field of view can be occupied entirely by either of the microscopic preparations or divided equally between the two. The median position of the prisms is marked and maintained.

The instrument therefore is virtually equivalent to two microscopes of the ordinary type but it possesses the additional and important advantage that the two objects under observation can easily and instantly be brought into the same field of view for close comparison.

This comparison microscope which is protected by a German patent is mounted on a hinged stand so that it can be used in a vertical or inclined position and it can be fitted with every accessory of the most elaborate microscope.

The Current Supplement

IN the current issue No 1937 of our SUPPLEMENT W Rosenhain concludes his article on Alloys Suitable for Instrument Work. Dr J E Teeple writes on Wood Waste Utilization.—Some extensive river improvements on the Missouri in which concrete piles have been used are described in an illustrated article.—Jean Dawson reports on the campaign against flies which the city of Cleveland has been waging with much determination.—Messrs Ellis and Dray describe a system whereby oils can be used in the ordinary type of gas engine.—Prof Runge writes on the Significance of Spectroscopy for the Atomic Theory.—Prof. Foley describes a remarkably elegant method of photographing sound waves.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents subscriptions books etc This will greatly facilitate answering your questions as in many cases they have to be referred to experts. The full name and address should be given on every sheet No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request

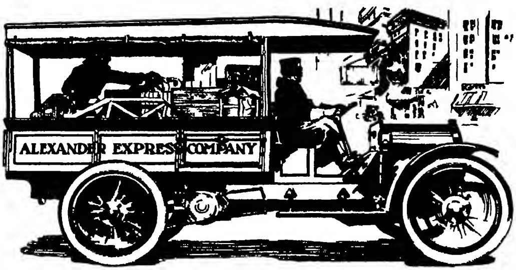
(12744) J A J H asks From time to time in houses I have seen weather glasses not of the mercury or aneroid classes In appearance these consist of a large-size test tube nearly filled with a pale yellow liquid with some white feathery substance floating in it Can you tell me on what principle these predict unsettled weather? Do you know of a receipt for making up the contents of the tube? In your opinion is this form of barometer (?) reliable? A The so-called weather glass, or storm glass is in no sense a barometer It contains alcohol in which camphor and other substances have been put a larger quantity than will remain in solution The glass is then sealed No effect of air pressure can reach the liquid within the glass There would seem to be no element of the weather excepting the temperature which can affect the liquid in the tube It is not possible that moisture should produce any change in the amount of camphor dissolved in the alcohol nor that this instrument should foretell the coming on of a storm A recipe given in the Scientific American Cyclopedia of Formulas price $5 is as follows 10 grammes of camphor 5 grammes of saltpeter 5 grammes of sal ammoniac 105 grammes of 90 per cent alcohol 45 grammes of water dissolved together

(12745) J F asks Can you tell me through your correspondence page which is the heavier—moisture or air? If this query is too general in character I can put it this way In discussing the reason for the excessive dryness of cigars kept in a case in which the moisture is supplied by a cylindrical device containing water which is suspended in the top of the case the point was raised that the moisture would reach the tobacco more effectively if the water was at the bottom as the moisture or vapor evolved by evaporation would rise rather than fall This led to a general discussion as to whether moisture or air as a general proposition is the heavier A Water vapor is about five eighths as heavy as air at the same temperature and pressure This however does not decide the question you propound because moisture will diffuse throughout any space in which it is, up or down whether the water is at the bottom or at the top All gases thus diffuse somewhat rapidly

(12746) C M M asks Will you kindly publish in the query column some explanation of the condition existing in many people myself in particular of what is commonly termed getting turned around or in other words, losing the cardinal points of the compass when traveling away from home I have in mind certain conditions in various cities under which it seems absolutely impossible to realize north as being in its proper place, even though I know it to be so A The fact is that every man is peculiar in certain points and to different degrees One man has an acute sense of direction so that he can tell the north and south direction in almost any place another is as you express it turned around very easily and cannot tell the direction in which he should go on coming out of a door upon a city street. It may be a dullness of sense perception and it may be that the man has not tried to educate his sense of direction It seems to be an individual peculiarity just as many other matters of sense and disposition are peculiar to an individual and constitute the individuality of the person

(12747) C F S asks I have been using an aluminium vessel partly filled with water in which a little baking soda has been placed for boiling silver ware in order to brighten and polish the silver ware. I had read the directions in a newspaper and tried the process with good results Would you kindly advise the chemical or physical principle by which the cleaning and polishing or brightening is done? Is it injurious to the silverware? A The process you describe for cleaning silver is mostly electrical or electrolytic the current between the silver and aluminium taking off an extremely thin layer of silver and leaving the ware clean Probably no more silver if as much is removed at each cleaning than would be removed by polishing with an abrasive silver polish.

(12748) J W G asks 1 A question in physics is under discussion. What is the lowest temperature that ice can register? I am informed that 29 1/5 deg Fahr is the lowest A. After water has frozen the ice is a solid and may be cooled to any degree below freezing just as any other stone may be. It cannot be heated above 32 deg. Fahr which is the freezing point of water and the melting point of ice 2. What is the reason that the heat is not lowered when ice is formed in a freezing mixture of say minus 200 deg Cent.? A. When water freezes it gives off heat, which tends to warm the surrounding air and cannot cool it as you seem to suppose. In a freezing mixture the ice is melted, and the heat necessary to melt the ice is taken out of the substance which is to be frozen, as in making ice cream. 3. Is ice a practical insulator at low temperature, and why? A In a sense ice might be called an insulator for heat, but the heat of the sun passes readily through it and may be felt on the other side of the ice. A piece of ice may be made into a lens and the heat of the sun focused by it so that it would burn the skin.



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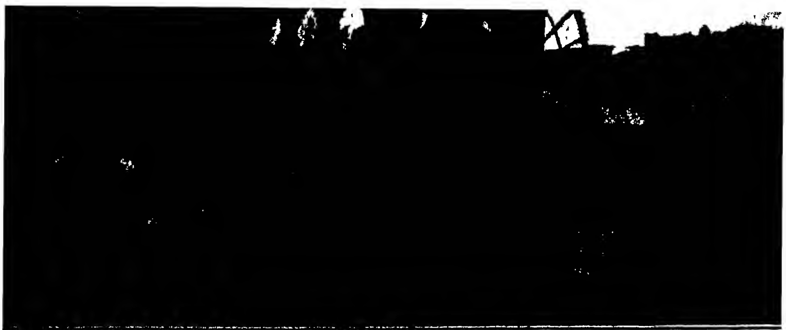

In northern Syria, on the banks of the river Orontes, are four waterwheels, each bearing a name of its own. They are used for pumping up the water of the river for irrigation.

THE UNDERSHOT WATERWHEELS OF NORTHERN SYRIA.—[See page 172.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement.

A Standard for Safe Railroad Travel

THAT the risks of railroad travel in the United States are beyond all reason is admitted. The question of the safety of the American railroad passenger is a relative one—to be determined by some accepted standard. For such a standard let us go back to the British Board of Trade's statistics of accidents in the United Kingdom for the year 1908, when out of one billion five hundred million passengers carried not one was killed. In that same year our Interstate Commerce Commission reported that out of less than a billion passengers carried, the number killed in train accidents was 105.

But we do not have to go outside of New York city for a standard of safe travel that exceeds even the British record, always bearing in mind the density of the traffic. The New York subway during the eight years of its operation has carried 1,664,510,822 passengers without a single fatality due to train accident. What makes the record so astonishing is the fact that about 70 per cent of these people were carried on express trains running at from 40 to 50 miles per hour and under the unprecedented headway (for the past few years) of 1 minute and 11 seconds. This feat, which in view of the high speed and short headway has never been approached, has been accomplished under shelter, it is true, and free from the hazards of the weather; but it sets a standard which is not impossible of accomplishment, surely, under the vastly greater headway of a trunk steam railway. The subway record is mainly due to excellent block signals and the automatic stop. Both of these should be made compulsory on steam roads.

We are well aware that the question of safety is largely one of discipline; but the subway officials assure us that the automatic stop conduces to discipline, for the reason that every operation of the stop constitutes a record against the man who passes a signal.

Comparative Cost of Direct and Single Phase Electrification of Steam Railroads

IN the absence of any definite figures as to the relative costs of the New York Central direct current and the New Haven single-phase installation, great value attaches to the report on the tenders which have been submitted by the leading electrical manufacturers of the world for the electrification of the extensive system of suburban railways of the city of Melbourne, Australia. The city railways enjoy a practical monopoly of suburban traffic, and although the service rendered by steam locomotives has always been excellent, the growth of traffic has been so great that the city has turned to electric traction as the only solution of the problem.

The present traffic on the roads affected is about ninety million passengers per year, and it is estimated that in 1917, after electrification, the total will have reached one hundred and fifty millions per year.

Before deciding on the system to be employed the Government and the Railway Commissioners decided to have complete alternative schemes prepared, one on the direct and the other on the alternating current system. Specifications were drawn up and tenders were invited, in response to which offers were received from the leading manufacturers of the world, who prepared complete proposals accompanied by stringent guarantees. Before inviting tenders, special pains were taken to see that the rival schemes were comparable and fair to the makers of the different systems. Since no serious criticism has been put forward by the exponents of either system, it is reasonable to assume that they were fair to all the parties concerned. The suburban lines comprise some one hundred and fifty miles, and the cost of converting these lines on the direct-current system was $11,750,000. To convert the same lines on the single-phase system would have cost $15,275,000. These figures, it should be explained, relate only to those items of capital expenditure which would be affected by the different systems. A comparison of the annual cost of the operation of the two systems gave the following results: Direct current, $1,270,870; single-phase, $1,523,705.

So that from this comparison of costs, based on the proposals of the leading manufacturers of the world for electrifying the same 150 miles of road, we find that the direct-current system shows an advantage in first cost of $3,525,000 and in the annual cost of operation of $252,835. It has been generally believed that although the direct-current system shows an advantage on suburban lines where the traffic is dense, it would be found that on longer lines with a relatively scant traffic the advantage would lie somewhat heavily with the single-phase system. In order to arrive at a just comparison, the engineer of the commissioners analyzed the relative cost of electrifying the Melbourne, Woodend and Bendigo line, which has a length of 100 miles. Even in this case it was found that the initial cost of conversion on the single-phase system would be greater by about $65,000, and that the annual cost of operation would be greater by about $8,100. The great importance of this comparison is realized when it is understood that the proposed conversion will cover altogether about three hundred miles of steam railroad tracks.

Under the direct current scheme, which is to be adopted, power will be supplied as three-phase alternating current at 25 cycles per second and a pressure of 20,000 volts. This will be transmitted, partly by underground cable, partly by overhead wires, to twelve sub-stations. There it will be transformed and converted to direct current at 1,500 volts. The trains will consist of from two to six cars operated on the multiple-unit system. The schedule speed for the suburban service, including stops, will be 21 miles per hour.

Shall We Have Compulsory Licenses?

THOSE who are responsible for the Oldfield bill seek to justify the introduction of compulsory licenses into the American patent system on the ground that England and Germany have adopted the principle with success. Representative Oldfield is haunted by the fear that meritorious inventions are suppressed.

Study the history of foreign patent legislation and you will find that the English and German working clauses were framed not for the purpose of preventing the suppression of inventions, but solely to protect manufacturers from foreign commercial invasion.

Thus, the English patent law is intended to give British manufacturers and the British workingmen an advantage over their more progressive German and American rivals, by declaring a patent forfeited if it has not been adequately worked within a stipulated period. Similarly the corresponding German laws, now all but abandoned, were intended to prevent foreigners from dominating German commerce.

If we may judge from the opinions expressed by British patent attorneys, England is awakening to the evil effect of her drastic patent laws. In a paper prepared for the Sixteenth Congress of the International Association for the protection of industrial property, held in London in June, 1912, Oliver Imray, Fellow of the Chartered Institute of Patent Agents, and Hugh Fletcher Moulton, Barrister-at-Law, had this to say with reference to the British Compulsory License Provision:

"The passing of Section 27 has certainly introduced an additional and very serious and complicated ground on which the validity of every patent can be attacked after four years, thus rendering it far less secure as a property, destroying to some effect the monopoly of fourteen years heretofore granted to a patentee, and deterring capitalists from financing the invention and so introducing the industry into this country. . . .

"The results obtained are infinitesimally small compared with the largest number of existing patents (100,000), even after deducting from this number those patents which may be considered of minor importance, and this, in itself, is an absolute proof of what a small call there was for this very serious and drastic alteration of the law, an alteration practically admitted by all countries from many years' actual experience to be a mistake. . . . For this very unimportant result, a slur on or an additional ground for questioning the validity of all the remaining patents stands out as a deterrent to the investment of capital for exploiting what may be very valuable inventions. . . . The effect of the passing of Section 27 of 1907, which we cannot help condemning as a retrograde step, has caused considerable agitation, antagonistic to British patentees in all countries of the world."

Between August 28th, 1908, and the end of June, 1912, eighty three demands were made for the revocation of patents, because the inventions which they covered were manufactured mainly in foreign countries. Of these eighty three demands no less than twenty were granted. On the other hand only one demand was made for the granting of a compulsory license and that demand was withdrawn by agreement between the parties.

The harshness of the British Act may be judged from a brief review of actually decided cases. Anyone can apply for an order, whether or not he has a real interest in developing British industries or not. It is irrelevant whether the applicant shows that the order will develop an existing industry or lead to the establishment of a new industry. Even though the sole purpose of the applicant is to import foreign made articles into the country free from the restraint of a British patent, the order must be granted. The lack of a demand in Great Britain for the article protected by the patent is not accepted as any excuse for failing to work it. If the article is made anywhere else in the world the patent owner must set about creating a demand for it in Great Britain. It will not suffice the patent owner to show that he has made genuine attempts to dispose of the patent, unless the Comptroller happens to agree that these efforts are all that a British business man should reasonably have made. The fact that a patent owner has done the best he could according to the standard of his own country or the country where the article originated is not enough. It will not suffice that the patent owner simply advertised that he desires to dispose of his patent, or that he sent around circulars stating that he wished to sell his patent, or intended to enter into a working arrangement to manufacture it in Great Britain. If the Comptroller finds that the advertisements, circulars, or other offers were framed vaguely and gave no intimation of the terms on which the patent owner was prepared to treat beyond the statement that such terms would be reasonable, the order must issue. Finally the Comptroller may decide that the unlucky patent owner, besides advertising and offering his patent to British manufacturers, ought also to have given demonstrations of the invention within Great Britain.

These actual British cases are of interest because some of them could easily arise if the Oldfield bill becomes a law.

Germany's experience has not been more encouraging. Indeed, the clause in the German patent law which required the working of patents has been practically abolished. Only in case the public interest (not the selfish interest of a private manufacturer, as the Oldfield bill would have it) is at stake will the Government interfere. Thus, the discovery of a new chemical compound which would curb an epidemic might be appropriated. This slight remnant of the old practice has been retained, not because of any unshakable belief in the virtue of revocation or of compulsory license, but because the German government feels the need of a weapon in negotiating patent treaties with countries that compel the working of patents. Such is the explanation of the German attitude given by A. duBois Reymond and Prof. Dr. Osterrieth, both distinguished authorities on German patent practice and both of whom have expressed their opinions in separate papers included in the recently issued report on the Patent Office submitted by the President's Commission on Economy and Efficiency. Both assure us that the popularity of the working clause has steadily diminished as the German people became convinced of its utter worthlessness and of the annoyance that it caused.

If the United States Government wishes to follow the German practice and reserve to itself in the public interest the right to appropriate certain inventions, there is no need of any such measure as that proposed by Representative Oldfield. Under the existing patent law the United States Government has the right to appropriate inventions upon the principle of eminent domain—a right which it has not hesitated to exercise. But the Oldfield proposal goes far beyond this feature of the German law. It seeks to establish over every kind of patents a species of eminent domain for the mere private, selfish purpose of whomsoever seeks to apply for a compulsory license.

All the testimony taken before the Congressional Committee, to whom the Oldfield bill was referred, conclusively establishes three points. First, that the existing patents laws of the United States are on the whole superior to the patent laws of Great Britain, Canada, Germany, France and any other foreign nation. Second, that from the point of view of the public, the inventor, the manufacturer, and the consumer, the provisions of the substitute Oldfield bill regarding compulsory licenses are worse than the corresponding provisions of the patent laws of Great Britain, Germany, France and other foreign nations. Third, that the experience of Great Britain, Germany, France and every other foreign nation that has tried anything resembling compulsory license, as proposed by the substitute Oldfield bill, has proved that, from the point of view of the public, the inventor, the manufacturer, and the consumer, compulsory license is a failure, and a distinct discouragement of invention.

Science

A Remarkable Photograph of a Meteor Trail is published in the *Bulletin* of the Astronomical Society of France, having been previously published in India, where the original was, on account of its unique character, awarded the first prize in a photographic competition held by the *Times of India Illustrated Weekly* It was taken by an English sergeant, A Hempstead at Mhow India. The meteor, which was very brilliant, was visible for about 2 seconds in its passage across the sky, but its trail persisted for 20 minutes. The photograph taken 1½ minutes after the passage of the meteor shows the trail as a very irregular sinuous line—the result of drifting in the wind

Long-range Weather Forecasting, so long discredited by scientific men, appears to be gaining respectability, little by little, with the progress of meteorology The last annual report of the Dutch East Indian meteorological service mentions the fact that forecasts of the strength and weather characteristics of the easterly monsoon are now issued at Batavia each April Official monsoon forecasts have been regularly made in British India for many years. In the United States Weather Bureau, Sunday forecasts for a week in advance have become an established institution Of course in all these cases the forecasts deal with only the broader features of the weather over wide areas.

Cataloguing American Doctoral Dissertations.—The Library of Congress has undertaken the important task of preparing an annual catalogue of the printed doctoral dissertations submitted at the various universities in the United States, exclusive of those submitted for professional degrees. This is a class of literature which librarians and bibliographers find particularly elusive, so that the new publication will fill a long-felt want Through the co-operation of the university librarians the Library of Congress hopes to acquire copies of all doctoral dissertations hereafter printed in this country, and to print catalogue cards for them. Eventually an attempt will be made to compile a list of the dissertations published before the beginning of the annual publication

Weather Reports from Arctic Canada —At the last meeting of the International Commission for Weather Telegraphy, Director Stupart, of the Canadian meteorological service, announced that the Canadian government would shortly be asked, through the Royal Society of Canada, to establish wireless stations at several far northern points, such as York Factory, Fort Chipewyan, Fort Simpson, and in Hudson s Strait, If this is done, arrangements will be made to have daily weather reports forwarded from these places – This would mean a very notable extension of the weather maps of Canada and the United States. Mr Stupart also reported that his service is now making a daily synchronous weather chart of the northern hemisphere, similar to that prepared in Washington, and that its value in forecasting has exceeded his most sanguine expectations.

Temperatures in the Antarctic —Some of the meteorological results of Amundsen's antarctic expedition are discussed by Dr Hann in the *Meteorologische Zeitschrift* Continuous observations were made at Framheim during the ten months, April, 1911, to January, 1912, inclusive From these, by comparison with previous records in the antarctic, values for February and March can be computed On this basis the mean temperature of the station for a year is found to have been −25.2 deg Cent. (−13.4 deg Fahr), which is the lowest yearly temperature heretofore observed at any place on the globe. The lowest individual temperature observed was −58.5 deg Cent. (−73.3 deg Fahr) Much lower temperatures than this have been observed in the "cold pole" of Siberia.

The Remarkable Haziness of the Atmosphere that began in June, 1912, and persisted at least well into the autumn, continues to be the subject of numerous reports from widely scattered points in the northern hemisphere Dr A. de Quervain, the leader of the Swiss expedition that crossed Greenland last summer, states that blue skies prevailed on the west coast early in June, before the party started During the crossing, however, June 10th to August 1st, the members of the expedition were struck by the gray, leaden appearance of the sky, in the absence of clouds, and even when the explorers were traveling at altitudes above 8,000 feet. The Eskimo of the east coast were terrified at this unwonted phenomenon, which they believed to be an omen that the following year would have no summer A report from Zurich states that the haze ceased to be noticeable at the Swiss observatories about October 11th. Dr Maurer, president of the International Solar Commission, has sent a circular to the principal meteorological institutions of the world requesting a careful examination of the tracings made by sunshine-recorders during the period in question, as a means of ascertaining the intensity and distribution of the phenomenon The coincidence of the beginning of the haze with the eruption of Katmai volcano, in Alaska, seems to leave little doubt as to the cause of the phenomenon.

Automobile

Heaviest Military Motor Truck.—The heaviest motor vehicle which has fulfilled all the regulations of the French War Department in connection with the subsidy arrangements, is the Avant-train Latil, which ogether with the trailer has a carrying capacity of 20 tons

Automobile Brakes that Operate a Signal —Charles F Marston of Great Neck, N Y, in a patent, No 1,-049,749, provides a signal device which is so connected with the brake mechanism that the signal is operated when the brake mechanism is manipulated to set the brakes, so that an automobile approaching another from the rear will be warned when the automobile in advance applies its brakes to reduce its speed or stop, thus preventing rear end collisions

Germany Has 825 Subsidized Road Trains. According to figures which have just been issued by the German government 120 motor "road trains has been subsidized for the year 1913 by the kingdom of Prussia, and 15 by Bavaria. This number added to the 690 which were under the control of the government in 1912, there are now 825 of these motor vehicles at the disposal of the German military authorities in case of war

Next Paris Salon in October —In view of the fact that heretofore the Olympia Automobile Show at London has been held a few weeks before the Paris salon, the importance of the latter has diminished to such a degree as to make the French exhibit a mere "appendix" to the British show To counteract this impression and to recapture for France its former high place in the automobile field it has been decided to hold the next Paris automobile exposition in October instead of November, so as to antedate the Olympia exhibit

Accident Statistics for Motor-car-miles --Someone with a predilection for statistics has figured out that in Great Britain alone about 1,600 000 000 miles are covered annually by all sorts of vehicles including motor cars During the past year 750 persons were killed by vehicle traffic, that is to say, one person for every 2,133,333 miles. Motor vehicles to the number of 50,000 covered approximately 300 000 000 miles and killed 200 people, or one person for every 1,500 000 miles

An Automobile for Fording Rivers —In order to meet with the rigid requirements of some of the British colonies in respect to motor cars which can be taken anywhere and everywhere, an English manufacturer has brought out a model which can be driven for miles through water four and even five feet deep All electric conduits magneto and batteries are protected by special insulations and extra lengths of pipe are attached to the exhaust pipe and to the intake manifold When a car of this type is driven through five feet of water only the top of the radiator and the seats show above the surface

A Daimler Lubricating System —Patent No 1,050,-108 to the firm of Daimler Motorengesellschaft of Stuttgart Germany, as assignee of Paul Daimler and Albert Hess of Cannstadt, Germany, shows a lubricating system which has a number of pumps for supplying lubricant to a number of corresponding parts to be lubricated, the pump cylinders being connected in series and to the parts to be lubricated with each cylinder having an oil inlet port and a piston reciprocated in each cylinder and over-running the inlet ports, so that each piston will operate to supply oil to the next succeeding cylinder on the compression stroke of such piston

Improvements in Carbureters.—It is a pretty well acknowledged fact that the action of many of the carbureters at present on the market is not all it might be from the point of efficiency and flexibility In this respect it is interesting to note that a number of car manufacturers have obtained a material increase in efficiency by the simple expedient of fitting an auxiliary air valve controlled by the operator To the person who takes an active interest in his car and its running the increase in efficiency and flexibility which in many instances can be obtained with the aid of a manually controlled air port, will more than offset the necessity for attention to its proper setting according to the demands of the motor

New Use for Postal Automobiles.—The Bavarian government has found a new use for the many automobiles employed by the Post Office Department by means of which the danger of great conflagrations in the rural districts is minimized If a big fire breaks out in any of the villages farther than ten miles from a city, the fire engines of the nearest city are attached to the postal automobiles and hauled at high speed to the point of danger As only the larger German cities have motor fire departments, the assistance of the postal motor cars is invaluable to the surrounding villages The first practical test of the plan was made last month in Bamberg The village Walsdorf asked the city for help and a small fire engine was fastened to the rear axle of the automobile, the run was made in 34 minutes, and the assistance rendered by this engine was of great value in extinguishing the fire.

Aeronautics

A Proposed Aviation Field at College Park, Maryland.—On January 14th Mr Gallinger introduced in the Senate of the United States a bill to authorize the Secretary of War to acquire the land now leased to the United States for aviation purposes at College Park Maryland, for aviation maneuvers and other military purposes. The sum of $400,000 is asked to carry out the provisions of the bill

An Alexander Graham Bell Flying Machine Patent.—In patent No 1 050 601, Dr Bell, instead of making the supporting surfaces of a flying machine flexible at their lateral marginal portions and flexing or warping those portions to preserve or restore the balance of the machine makes such supporting surfaces rigid and non-flexible and employs a vertical balancing rudder which, when the machine is in normal horizontal position, lies approximately in the medial vertical fore and aft plane of the machine The rudder is mounted on an upright axis, and when the balance of the machine is disturbed, the rudder is by suitable means turned about its axis to incline it to that side of the axis toward the lower side of the machine, the resistance offered by the air as the machine moves rapidly forward, operating to again restore the balance of the machine when the rudder is returned to its normal position The axis of the rudder is preferably located approximately at the center of pressure of the air acting to support the machine For operating the balancing rudder, an arm projects from its upright shaft and has a fork which embraces the body of the aviator who, when the balance of the machine is disturbed, naturally inclines his body toward the upper or higher side, thus turning the rudder to the lower side of the machine for the purpose before described

Recommendations of the Chief Signal Officer of the United States Army —In his annual report to the Secretary of War Brig -Gen James Allen, Chief Signal Officer of the Army invites attention to the recommendation made in previous reports concerning the urgent need of legislation to increase the efficiency of the Signal Corps of the Army During the past few years the great development in radio-telegraphy, aviation, and in the organization of field signal companies has so greatly increased the duties devolving on the Signal Corps that the present authorized personnel is inadequate to perform the present work of the Corps He asks an appropriation of $3,-000 000 to be distributed as follows One million dollars for increasing the present equipment of aeroplanes, hydro-aeroplanes and other aircraft for the purpose of warfare and national defense, six hundred thousand dollars to be spent for one hundred aeroplanes two hundred thousand dollars to be spent for maintenance, including service, spare parts, gasoline oil etc , two hundred thousand dollars to be spent for auxiliaries, including hangars, tractors, motor-trucks etc , and one million dollars to be spent for the establishment of training schools known as centers of aviation, on the Atlantic, Pacific and Gulf coasts, on the Great Lakes and some central interior point and as many auxiliary centers as it may be possible to organize with a view to having a school of instruction in each State for the purpose of training officers of the regular army and organized militia as aviators

Curtiss Awarded Collier Trophy for 1912 and 1913.—Glenn H Curtiss flying motor boat, the last word in aviation, and the creation which is said to have made aviation a safer pastime than either automobiling or boating has won him the distinction for the second time, of receiving the Collier Trophy awarded annually for the greatest contribution to the advance of aviation, which shall have been developed and demonstrated during the preceding year The SCIENTIFIC AMERICAN Trophy was won by him in 1908 when at Hammondsport, N Y, July 4th he made the first public flight in America of more than one kilometer He actually flew a distance in excess of a mile in the old 'June Bug' In 1909 almost exactly one year later, Curtiss won the SCIENTIFIC AMERICAN Trophy for the second time at Hempstead Plains, he flew 24 7 miles or nineteen circuits of a circular course His famous flight from Albany to New York the longest flight of the year, won him the trophy in 1910 for the third consecutive time making him its holder in perpetuity In 1911 the new trophy, to be awarded for the most signal advance in aviation each year was offered by Robert J Collier then president of the Aero Club of America It was awarded to Curtiss that year for the invention and demonstration of the single pontoon hydro-aeroplane, the first machine to successfully rise from and alight on the water There is no record of a single serious accident to the operator of a hydro-aeroplane in America, though one machine and its operators were lost at sea in attempting to fly in a home-built hydro a distance of upward of 400 miles, from San Pedro to San Francisco, starting in a fog following a three days' storm The hydro-aeroplane perfected by Curtiss has been adopted by almost every navy of the world's powers.

Motoring on Ice

IF by putting skates on his feet a man can outstrip a horse, if by putting runners on a sailboat it can be made to race an express train why should not an automobile if mounted on runners develop a speed that would satisfy the cravings of the most voracious of speed maniacs? The logic is not perfect. Nevertheless an automobile has actually been mounted on runners and has attained remarkably high speeds. The experiment we refer to was made by Mr. Fred Waters of Red Bank, New Jersey. He stripped his car of all superfluous weight and mounted the chassis upon two pairs of runners. The rear wheels were left upon their axles, but the tires were removed and in their place toothed tires were used. The rear runners took most of the weight of the wheels, merely permitting the teeth to dig into the ice and snow and propel the machine. With this novel craft Mr. Waters had great sport travelling over the broad stretches of the Shrewsbury River.

He was not long without rival however. Mr. Phillips Green, also of Red Bank, came out with a peculiar craft built after the fashion of an iceboat, but provided with a motor in place of a sail. The motor was equipped with an aeroplane propeller. A crude-looking propeller it was too and it was driven by a 12 horse-power 2-cylinder motor. The automobile iceboat, on the other hand, was equipped with a 10 horse-power air-cooled motor. A race was arranged between the two sleds and the air-driven craft easily showed its superiority over the automobile. One of our illustrations shows the two machines just after the race. However, the automobile was more powerful when it came to travelling through snow and it was used to drive a snow plow to clear the ice, as pictured in one of the photographs.

One of the speediest of motor iceboats is the "Go-devil," built for Dr. L. Neumann after the design of C. H. Davis. It is fitted with a 40 horse-power, four-cylinder two-cycle motor, water-cooled, and an aeroplane propeller designed to drive the machine at 120 miles per hour. The propeller is placed in front of this boat and the steering rudder at the rear. When this machine was tried out last year at Irondequoit Bay, Lake Ontario, it developed such speed as to astonish the spectators. A reporter who was present was positive that the machine had made 140 miles per hour on the seven-mile stretch of good ice, and this story appeared in the New York daily papers. As a matter of fact the machine was not travelling at its highest speed, but was partly throttled down. The operator of the machine conservatively estimated the speed at about seventy miles an hour with the wind at his back, and he did not feel inclined to let the machine travel any faster on her trial trip at least. Unfortunately, the good ice did not last long and the next trial had to be made on snow-covered sheet. The snow was five inches deep. But even with this heavy handicap a speed of 40 miles per hour was easily obtained. The accompanying photograph of the "Go-devil" plowing through the snow at this speed shows how much of its energy was wasted in throwing the snow rather than propelling the machine forward.

Motor iceboating is in its infancy, but it is one of the most fascinating and exhilarating of winter sports, and its development in the past few years offers alluring promises for the future.

Astronomical "Bulls"

THE *Bulletin* of the Astronomical Society of France, otherwise known as *L'Astronomie*, has for some time been publishing from month to month, delightful specimens of popular ignorance concerning the elementary facts of astronomy, some of which have already been mentioned in our columns. The following are recent additions to the collection. An astronomer happened to remark that he had taken some photographs of the moon through his telescope, whereupon he was asked whether he took them by flashlight. A member of the French Academy, M. Rene Bazin, in his novel "Les Noellet," the scene of which is laid in Vendee, makes a peasant look up his cottage chimney one summer night, and see, in the zenith, the belt of Orion.

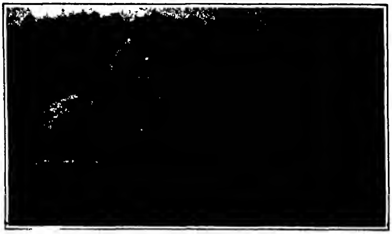
The Waterwheels of Hama

HAMA, in northern Syria, is justly famous for its huge waterwheels. The city lies some 110 miles northeast of Damascus on the banks of the river Orontes. It is undoubtedly a very ancient town, and is referred to in the Bible as Hamath the Great.

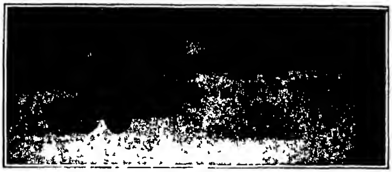
The river flows through the city in the form of an S, and upon its banks are four huge waterwheels, each bearing a name of its own. They are used for pumping up the water of the Orontes for irrigation purposes, and also for supplying the town.

The wheels are driven by the flow of the river on what is known as the undershot principle, that is to say, the wheel is moved by water passing beneath it.

Automobile sleigh and motor iceboat just after a race which the latter won.



Twelve horse power propeller-driven iceboat



Automobile sleigh clearing the ice with a snow-plow

The "Go-devil" plowing through five inches of snow

The largest wheel has a diameter of about 70 feet, and the Syrians declare it is the largest in existence. Like the others, it is built of wood, a dark mahogany. The axle is of iron. The creaking of the wheels is incessant day and night. They never stop. In winter and during early spring the flow of the stream is partially blocked to reduce the rapidity of the revolutions, but on no account are the wheels actually stopped.

Placed upon the banks of the stream amid the trees and gardens for which Hama is justly proud, the wheels present a decidedly picturesque effect. They are the favorite rendezvous of the boys of the town. For a few cents some of the more daring will climb up the spokes of the moving wheel to the summit and then jump into the stream below him.

Fortunes in Foxes

THE phenomenal expansion of the black fox industry in the province of Prince Edward Island, Canada, has been made the subject of an elaborate report by the American consul at Charlottetown. That province is, it appears, the greatest center for fox farming in the world, thanks to the possession of a climate and soil that ensure an ideal weight, texture, and color to the skins. More than 80 per cent of all the captive foxes in Canada are kept on Prince Edward Island.

Black foxes (which include the silver foxes) furnish a skin which is not only extremely valuable, but is in such constant demand that its value has become almost as fully standardized as that of the diamond among precious stones, and does not necessarily fluctuate with the supply. These skins frequently fetch from $1,500 to $3,000 on the London market, the record price up-to-date being somewhere between $3,800 to $3,900. Aside from the industry in skins there has grown up an immense business in live animals for breeding purposes. It is stated that during the past summer $10,000 a pair was not an unusual price, as compared with $4,000 a pair for animals of the same quality in 1910. Prices of $12,000 to $15,000 a pair are paid for animals that have shown unusual fertility, and it is rumored that a 2-year-old pair recently sold for $30,000. One of the pioneer ranchmen claims to have refused an offer of $500,000 for his establishment, coupled with a salary offer for his own services to run it. Fourteen companies for fox ranching have been incorporated in the island, and capital from the United States is beginning to be invested in these concerns. There are now about 50 large ranches stocked with pure-bred animals, while the number of places where from one to four or five pairs of some variety of foxes are kept is probably more than 300.

All the foxes on Prince Edward Island are now in captivity, the last wild fox having been killed early in 1911. It is claimed that the valuable strains have been improved in domestication. The animals are kept in pens or paddocks about 30 by 40 feet, surrounded by a large outer enclosure sometimes covering an acre or more. The fences are of 16 or 14 gage "fox wire," which is now specially woven for the industry. They are 9 or 10 feet high, with an overhung wire shelf extending inward, and are sunk 2 or 3 feet in the ground. The kennels or fox houses are inside each paddock, or immediately outside, but opening into it. The mouth of the kennel is a crooked tube or spout, often built to imitate the entrance to a natural burrow.

The diet of the animals is extremely varied, including meat, fish, fowl, small game, mice, and insects, beside various prepared foods, such as hardtack or sea biscuit dipped in milk and patent dog biscuits. Overfeeding must be avoided, especially at the breeding season, but a full diet for a few weeks before the pelt is taken is said to make the pelt more glossy, and is a common practice. Each animal costs from $10 to $15 per annum to feed.

The foxes often breed when they are but 8 months old. Each vixen, or female, will breed 8 or 10 times in the course of a lifetime, and a litter contains from 2 to 7 or 8 pups, the usual number being about 4. During the mating season the animals are exceedingly wild and shy, and, in fact, at all seasons, the fox is a very sensitive and high-strung animal, so that a great deal of experience is needed for its successful handling.

The recent rapid development of this industry has raised a number of difficult problems, which are gradually being solved. There is at present considerable agitation on behalf of some kind of registration of pure-bred island foxes, looking toward the formation of an association of breeders for the purpose of establishing a species of "herd book," in which to record pedigrees of valuable animals. It is expected that ultimately this task may be undertaken by the Live Stock Branch of the Dominion Department of Agriculture.

Our Latest Battleship "Pennsylvania"

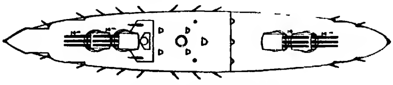
The Largest, Most Powerful and Best Protected Battleship in Any Navy

IT is the policy of our Navy Department to build its new battleships in divisions of five and to make these ships in every respect identical. It is part of this policy to send each of the ships of a division in turn to a navy yard for overhaul and general refitting, leaving the fleet in commission made up of so many divisions of four ships each. The Department asks annually for a sufficient appropriation to enable it, among other things, to build so many ships of a certain type. Usually, Congress appropriates the money more or less, leaving the question of design to the discretion of the Department, where it properly belongs. Occasionally, however, Congress has gone out of its way and specified what size or type of ship it desires. This is always disastrous, for it interferes with the Department's regular programme of construction and arbitrarily introduces into the fleet a ship or ships, which, because of differences in size, speed, turning circle, or arcs of training, cannot maneuver effectively with the ships of the divisions to which they are allotted. The "Idaho" and "Mississippi" are a case in point. They are small "Connecticuts," of 3,000 tons less displacement, a couple of knots less speed, smaller radius of action and other differences which greatly mar their usefulness.

When Congress appropriated last year the sum necessary for the construction of one unusually large battleship—some 1,500 tons larger than any existing ship in our fleet—the Department was confronted with the old problem, and had to determine whether to make the "Pennsylvania" come into the class of the "Nevada" and "Oklahoma," authorized the year before, or to constitute her the first of a new type. The "Pennsylvania" is an enlarged "Nevada," and in outward appearance is so like that ship that to any but the experienced eye, she will look, when she is steaming in division, to be practically identical. She will be forty feet longer, of about two feet more beam and a little more draft. Two guns will be added to the armament, giving her the powerful battery of twelve 14-inch guns. Like the "Nevada" and "Oklahoma," she will have oil burning boilers of the water tube type and, probably, she will be turbine driven. Her armor will be somewhat heavier, and as the "Nevada" and her sister are admittedly the most powerfully protected ships as yet designed, the "Pennsylvania," because of her size, gun power, and efficient protection, will take rank as the most powerful dreadnought built, building, or authorized by any of the leading powers.

The principal dimensions of the ship are: Length over all, 625 feet, beam 97 feet, draft, 29 feet, and displacement on this draft, 31,000 tons. This last will be her trial displacement, and it represents the flotation of the "Pennsylvania" when she is carrying two thirds of the full supply of stores and fuel and a full supply of ammunition. Her full load displacement will be 32,500 tons.

The "Pennsylvania" will be no less than 3,500 tons larger than the "Nevada." A part of this weight will be consumed by the two additional 14-inch guns and the greater weight of the two three-gun over the two two-gun turrets which they replace. There will also be, of course, an increased weight of ammunition. A large part of the 1500 tons also will be consumed by the increased length of the ship and the greater weight of the frames, decks, beams and deck plating due to her increase of beam. Then there will be a very large consumption of weight due to the increased length of the side armor. There will be a slight thickening up of the armor plan over that of the "Nevada." Furthermore, the boiler and engine plant must be enlarged somewhat to drive the heavier ship, although the fining out of her lines, due to her greater length, will go far to offset the increased load. Finally, and very important, will be the larger fuel supply, with the considerable increase which it will give to the radius of action.



Deck plan of the "Pennsylvania."

The disposition of the turrets will be similar to that of the "Michigan," which, by the way, affords the most efficient distribution of the guns for securing a maximum of all-round fire. There will be two three-gun turrets above the forecastle deck, the after guns training above the roof of the forward turret, and there will be a similar pair of turrets aft. This will give an end-on fire, both forward and aft, of six 14-inch and a broadside fire of twelve 14-inch guns.

The three guns in each turret will be mounted in a common sleeve, so that they will be elevated together, and the three shells, if there is no variation in the powder, must fall absolutely together—a matter of great assistance to the spotter. There will thus be four gun pointers in place of twelve, and errors of range should be greatly diminished. The torpedo defense battery will consist of twenty-two 5-inch guns carried chiefly on the main deck about twenty-two feet above the water line. The armament will also include four submerged 21-inch torpedo tubes.

In a recent discussion of dreadnoughts before the Society of Italian Architects, a distinguished officer stated that the dreadnoughts of the United States Navy were better protected than those of any other navy. Unquestionably this is a fact, and it is our decided opinion that the policy of making the protection of the flotation of the ship and her main armament of paramount importance will stand us in very good stead when it comes, if it ever does, to the trial of a line-of battle engagement.

The hull of the "Pennsylvania" is most fully protected. The main belt is eighteen feet in depth and fourteen inches in thickness, it extends far below the waterline. At the foot of it, from the armor shelf springs a 2-inch protective deck, which slopes upwardly to about the level of the waterline. At the top of the armor belt is an upper protective deck. The main belt extends to near the ends of the ship, and its extremities are joined in transverse bulkheads of heavy armor. The barbettes are 14 inches in thickness. The sloping port plates of the turrets are no less than eighteen inches thick. The roof armor has been thickened to five inches.

To protect the base of the single smokestack and prevent the escape of poisonous furnace gases between decks, heavy armor is carried around the base.

The battery of torpedo defense guns is without any armor protection whatsoever. To place relatively thin armor on this battery is to make certain the bursting of armor piercing shells, which might otherwise pass entirely through the thin plating of the ship.

Because of the wider space available due to the absence of side bunkers, the boiler rooms are placed together under one large central smokestack.

No attempt will be made to utilize additional displacement of the ship for any great increase of the motive power and speed. The speed will be only a little greater than that of the "Nevada" and "Oklahoma," or say about 21 knots.

The "Pennsylvania," therefore, will be an enlarged and considerably more powerful "Nevada." Her guns will have the same arcs of training and she will be so designed that she can maneuver with the same turning circles, etc., as her smaller sister. If Congress appropriates this year for two more "Pennsylvanias," we shall have a division of ships which cannot be matched in any navy of the world.

The "Pennsylvania" embodies the combined experience and judgment of the sea-going officers and the naval constructors, and the Department is to be congratulated in having produced such a fine compromise of the many conflicting requirements of the modern warship.

This "super-dreadnought," 625 feet long, will carry twelve 14-inch guns behind 18 inches of armor in four 3-gun turrets. In gun power and armor protection she is the most powerful ship in any navy.

The latest U. S. battleship "Pennsylvania" of 31,000 tons.

Protection of Wooden Poles Carrying Electric Wires Against Decay

IN *L'Industria* M. Maier proposes to protect that part of the pole sunk in the ground by encircling the critical zone of the pole (surfaces of contact between air and ground) for a variable height from 16 to 40 inches, according to the humidity and nature of the soil, with a round sheet of iron having a diameter of from 8 to 16 inches larger than the pole, so as to leave between the outer surface of the pole and the inner surface of the sheet an empty space, which is to be filled with a melted product derived from the distillation of tar and which boils at about 300 deg. Fahr. This product penetrates and saturates the critical zone of the wood and after is solidified in a uniform and compact layer, retaining, however, the necessary elasticity to follow the vibrations of the pole, at the same time protecting it from water and insects. Poles which have been already attacked by rot, and should be exchanged, may give further use by excavating the ground around them, scraping off the decayed part, burning it superficially with coal oil or kerosene and using the above described method. If it is necessary to remove a pole so protected, all there is to be done is to excavate the ground at one side, heat the sheet of iron until the mass inside is melted and extract the pole.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Card Trick

To the Editor of the SCIENTIFIC AMERICAN:

In reference to the article "Another Card Puzzle," which appeared in the October 5th, 1912, issue of the SCIENTIFIC AMERICAN, I would advise those interested that the trick, as I call it, can be done with any number of piles of cards from one to five inclusive, the latter number being the best, as there would be fewer cards left, and if the face cards are valued at ten each, three added to the number of cards left will give the total of the bottom cards on the five piles.

To make this trick seem more mysterious, ask the party counting to put two cards on each pile, then one on each, or two on the first and second piles, and so on in any manner that you wish, until the cards remaining have all been used. This is done to find out the number of cards without asking for them or without letting anyone know that you must have the number. I find that this adds immensely to the effect of the trick.

New York city. R. W. HOYL.

Required, a Machine for Shaping Granite Cubes

To the Editor of the SCIENTIFIC AMERICAN:

A pavement somewhat similar to that which has been in use in the streets of Liverpool for a number of years past has recently been laid in Fulton Street in this city. This pavement, which consists of small granite cubes some three or four inches across, accurately cut so as to admit of laying with close joints, seems to be better adapted than any other to meet the requirements of heavy street traffic, and at the same time affords a good footing for animals. The chief obstacle to its extensive use lies in the fact that the cost is considerably greater than most other forms of pavement.

It has occurred to me that these granite cubes could be produced at a lesser cost if labor-saving machinery were employed in shaping them. Would you kindly call this requirement to the attention of inventors throughout the country, in the hope that they may be able to solve the difficulty? HENRY BRUOR,

Chairman Committee on Improved Pavement.

New York, N. Y.

[If the cubes are shaped by hand, their relatively high cost is readily understood. It should not be difficult to devise suitable machines for doing this work.—EDITOR.]

Determining Differences in Longitude by Wireless

To the Editor of the SCIENTIFIC AMERICAN:

The paragraph in your issue of October 5th regarding the proposed use of wireless by the Belgian government for the exact determination of difference of longitude, induces me to remark that this device was successfully employed last summer by Canadian government vessels. The work was performed by the "Arctic" and "Minto" and consisted in the charting of the Button Islands at the entrance to Hudson Strait.

While one vessel remained at anchor, the other visited the various islands which compose the group. Each day (the weather permitting) observers from each vessel made careful short observations for local time and then, as soon as possible, these times were compared by wireless.

The distances involved ranged from thirty to fifty miles, and it was found that by pressing the key at intervals of a minute for four or five minutes an accuracy in transmission considerably greater than that of the observation itself could readily be attained.

The method proved satisfactory in every particular, and its rapid extension seems assured.

Berlin, Ontario. W. B. WIEGAND.

The Carob Bean Tree

To the Editor of the SCIENTIFIC AMERICAN:

Your interesting article on "The Carob Bean Tree" in the January 11th issue of your highly esteemed paper reminded me of my observations of this tree. It grows here in a wild state, both the bean-bearing and the male tree. The latter is used for posts of various kinds, is very durable and hard, also rapid growth. The female develops less rapidly and has thorns from eight inches long down to very small ones on the smaller branches. The beans or pods are flat and black and measure as long as sixteen inches and about one and one half inches wide, the honey lying in the thicker portion of the pod and the beans in the thin. I have seen them over eighty feet in height, and the lumbermen call them "black locust." I know of a row of the male locusts near here, about one quarter mile long, which were originally posts for a wire fence, and were allowed to grow into trees now about fifty feet high. I have also seen telephone posts made of this variety which developed into beautiful trees. They bloom in early spring, with great clusters of pendulous, creamy white and very fragrant blossoms, the foliage is also very graceful. Cold does not affect this tree here. The Louisiana orange is grown some four hundred miles south of us and does not stand our climate. This tree is very hard to kill by cutting down, as it will invariably put out not only suckers from its most abundant roots, but will also sprout from the stump. The soil here is rich and sandy below the surface, with a good layer of rich black topsoil, the lowest stratum is gravel of an exceptional quality. In my younger days we would bind the long hard thorns to a lance of bamboo cane and use them for snake spears, and with their many tough prongs they answered admirably for this purpose. Incidentally I have used a smaller thorn in place of a lost suspender button, the utility of which can be imagined. The male locust is also known here as "locust and wild-honey" tree. Negro children sometimes eat the honey portion, but it is never used as a food. Neither the male nor female trees are ever green here, and we are perfectly bare of trees now. I have seen these trees in Miami, Florida, in Arkansas, Tennessee, Texas, and Louisiana, besides my home State, Mississippi. It is interesting to know that there is more value attached to this tree than was supposed here.

I send you this little article for what you may wish to do with it. I have had the benefit and pleasure of being a subscriber to and reader of your valuable paper for twenty years, and I still look for its weekly advent with pleasant anticipation. F. F. BRSSAC.

Natchez, Miss.

Misuse and Failure of Metals and Alloys

To the Editor of the SCIENTIFIC AMERICAN:

In order to bring about a better understanding between the users and manufacturers of metals and alloys, I venture to request the favor of the insertion of this letter. I hope it may provoke discussion, and if possible help us to arrive at the truth.

Users including the non-expert public of metals and alloys in general do not sufficiently realize that many of their corroded metallic wares, for example copper pans and boilers, mysterious breakages of for instance chains, railway accessories, and sudden failures of condenser tubes and copper pipes, are due to two easily preventable causes described below.

In order to satisfy the demand for beauty of form or the modern craving for cheapness, many ingenious mechanical devices have been evolved by manufacturers' works staffs, which put upon the metallic articles, while being made, uneven strains, or introduce in antiquated furnacing appliances deleterious compounds, which tend to and in varying times finally render the articles useless in the hands of the purchasers or users. Often enough they are dangerous to human life and property. An attempt is made to remove these strains by annealing in unevenly heated furnaces.

Why this state of things?

One must reply, "general ignorance," perhaps "apathy"—the major causes of most human troubles.

A few manufacturers whose products are subject to constant physical tests are quite alive to the situation. It must also be conceded that manufacturers of ferrous and non-ferrous metals and alloys spare no pains to free them while in the molten state from deleterious substances. They employ expensive nostra known as deoxidizers—ingenious devices to prevent contact of the liquid metal with the air during the casting operations, all tending to produce soundness in the ingots or castings, i. e., to free them from blowholes and segregations.

No sooner is this desirable end attained than the metal or alloy is introduced into furnaces wherein hot gases containing free oxygen, sulphur, and other objectionable elements are allowed to impinge upon or envelop the metal. While hot, they are brought out of the furnace into the air and mechanically treated in an atmosphere containing oxygen. This operation is often repeated several times. In cases of cold working, the metal, with few exceptions, is annealed between processes in furnaces to which the air has access. After this heat treatment they are withdrawn and allowed to cool, sometimes in approximately closed receptacles, oftener in the air. Not only is the surface of the metal oxidized or tarnished, but during the whole time of heating, and partly in cooling, solution of oxygen and other gases takes place, with formation of compounds in intergranular spaces, or in the body of the metal or alloy, which form centers or areas of corrosion when in use.

In the last year or two exact investigations and experience have proved beyond doubt that both the above defects in heat treatment are prolific causes of corrosion and the other breakdowns.

I therefore with all respect beg leave to submit that the time has arrived for all engineers and users of metals and alloys to insist and specify that, at least, two causes of failure of metals and alloys under the control of the makers shall be removed, namely: (a) Uneven heating appliances. (b) Antiquated heat treatment in chemically and physically active atmospheres.

Incidentally the public health will benefit, because all the appliances on the market capable of bringing about the above results are smokeless when in operation. The present unnecessary and wicked waste of one of our natural resources, viz., coal, will also be curtailed.

T. VAUGHAN HUGHES, A.R.S.M.

Birmingham, England.

Bursting of 13.5-inch and 14-inch Guns

To the Editor of the SCIENTIFIC AMERICAN:

In your number of December 14th last, when speaking of the bursting of an English 13.5-inch gun, which had taken place in Shoeburyness a few days previously, you alluded to the fierce controversy which had taken place a few years ago, respecting the question of the relative strength of the wire-wound guns and hooped guns. Starting from the justified assumption that the English gun which burst was wire-wound and of the most recent pattern, you recalled to mind that "the advocates of wire-wound construction claim, or did claim, before the recent improvements in hooped guns, that the wire-wound gun, because of the absolute inspection to which every part of it could be subjected, was proof against the kind of accident which recently happened at the proving ground."

From the wording of the article it results clearly that you had doubts as to whether the claims of the manufacturers of wire-wound guns were well founded, and I presume that these doubts will have been further strengthened by the bursting of a 14-inch wire-wrapped gun which took place at the Sandy Hook proving ground on December 9th. As appears from the *Army and Navy Journal* of December 14th, the gun, after having fired a first shot with reduced charge, burst at the second discharge with a normal charge of 320 pounds powder and a projectile of 1,660 pounds, producing a pressure of 42,000 pounds per square inch, while the contract strength of the gun called for a minimum of 55,000 pounds.

This is quite an extraordinary event, which, taken together with that which had taken place in England, where the 13.5-inch gun burst at the seventh discharge, shows that the criticism against the wire-wound guns is well founded, and that it is, in fact, not true that the latter have a circumferential strength greater than that of the hooped guns.

That the wire-wound guns are very defective as regards longitudinal strength is a matter which is now so well known that there is no need to demonstrate it, and in connection therewith it will be sufficient for me to refer to the important article which was published on this subject in the February-March number of the *Journal of the United States Artillery*.

As regards the circumferential strength, I beg to call your attention to the two important essays which were published in the "Memorial de l'Artillerie Navale" of 1912 by the ordnance and naval engineers Messrs. Léon Coupaye and Pierre Malaval.

Those two gentlemen have exhibited, by different methods and procedures, the following principle: "Whatever may be the system according to which a compound gun is constructed, whether it is hooped or wire-wound, the internal pressure which it can resist without altering its shape permanently has as its upper limit the value of the limit of elasticity of the metal of which its internal tube is manufactured."

Thus, for instance, a gun the inner tube of which is manufactured of a metal with a limit of elasticity of 40 kilos, cannot resist, without a permanent deformation, an internal pressure exceeding 4,000 kilos per square centimeter (56,891 pounds per square inch). This limit of internal pressure can, however, be reached only in case the internal tube is of infinite thickness. It is less in practice, and decreases with the thickness of the tube.

In the wire-wound guns, the internal tube is of small thickness and strongly compressed by the steel ribbon surrounding it externally. The limit of elasticity of the ribbon is superior to that of the tube, and consequently under a given pressure, the latter suffers an elongation greater than that of the ribbon. When the entire arrangement returns to its state of repose, the tube can no more retake its former dimensions, because it does not find the necessary space to do so and, consequently, contracts or breaks. The contraction of the internal diameter of the wire-wound guns is a well-known phenomenon which I have personally ascertained; it has been, may be, and will be the cause of the jamming of the projectile in the bore, and of the consequent bursting of the gun.

I think that to this cause must be attributed the bursting of the English 13.5-inch gun, as well as that of the American 14-inch gun, and it seems to me that these two accidents, which took place within a few days of each other, must give rise to serious thoughts.

Torino, Italy. ETTORE BRAVETTA,

Captain Italian Royal Navy (retired).

[The theory of our correspondent regarding the cause of the bursting of the 13.5-inch gun is decidedly interesting. He is wrong with regard to the American 14-inch gun, whose failure was due to other causes which we are not at liberty to disclose.—EDITOR.]

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Capt. Roald Amundsen who discovered the South Pole on December 14th, 1911 and who was at one time only five days journey from the ill fated Scott party

Sir Ernest Shackleton who was Scott's second in command on the expedition of 1901-1904 and who led a party of his own to a point within 97 miles of the South Pole in 1909

Capt. Robert Falcon Scott who discovered the South Pole on January 18th, 1912 and who perished with four companions on his return journey

Three explorers who have made Antarctic history

The Scott Expedition and Its Tragic End

A Sacrifice Made for Scientific Ideals

IN the desolate, icy waste of an unexplored Antarctic country Capt. Robert Falcon Scott gave up his life, after having reached the South Pole. He died a true hero of science. There was no buried treasure to seek in those untrodden southern snows—nothing but everlasting fame. Only those who are engaged in scientific research can understand the ideals of a man who willingly cuts himself off from the world for a period of three years and perishes in a blizzard—for what? For meteorological information, for geological data, for light on the fauna and flora of a cold, white, silent land that will probably never be peopled, for a handful of rocks and fossils that will show the relation of the Antarctic Continent to South America and Australia, for a study of the southern atmosphere and the southern seas, in a word, for things that are infinitely removed from gold hunting.

Let it not be supposed that the cause in which Scott died was the mere attainment of the South Pole. If that "athletic feat," as it has been termed, were the only object of polar exploration, scientific societies would not contribute a penny to the equipment of an expedition. Nor would men of Scott's and Shackleton's attainments be interested in it. A polar dash makes good newspaper reading, but your scientific geographer looks primarily for some addition to the world's knowledge.

The Great Unexplored Antarctic Continent.

Until the close of the nineteenth century there was no part of the world about which less was known and none about which so little interest was manifested as Antarctica. The reason is to be found in its distance from the centers of wealth and thought, in its dearth of animal and vegetable life, and in its unpeopled state. The game hunter, the dare-devil explorer seeking adventure, found little to attract him in that bleak and barren country. It was a region that held a fascination only for the scientifically inclined man, and hence we find that most of the men who have braved its terrific blizzards have been men of the finest scientific type.

Definite knowledge of the Antarctic regions was acquired very late in the nineteenth century. Indeed, to Capt. Scott belongs the credit of having first penetrated Antarctica during his first expedition of 1901 to 1904. Before that time geographical knowledge of the South Polar regions was confined largely to sea approaches. To be sure, Palmer Land with its associated islands, the coast of Victoria Land with the adjacent Ross Sea, and to a lesser extent, the coast of Wilkes Land had been explored; but of the great Antarctic continent as a whole, practically nothing was known before Scott's first expedition returned. True, the examinations of the Belgica, the Francais, and the Pourquoi Pas showed that Palmer Land extended away to the southwestward along the southern confines of the Pacific Ocean, and the German Gauss Antarctic Expedition confirmed the discoveries of Wilkes, made in 1840 and so long discredited. But the first who really scaled the Great Barrier and gave us some idea of a continent whose present unexplored and unvisited extent is still twice the area of Europe was Scott. Thanks to his studies, supplemented by those of Shackleton, we know that in former geologic times the continent was probably connected with Africa, South America, Australia and New Zealand, although not with all of them at the same time. The first phase of any journey which has for its object the exploration of this vast territory must be over the plateau of the Great Barrier, the second a climb through mountain passes, and the third a traverse of a lofty inland plain. Not all the explorers who managed to ascend the Great Barrier could take any means of transport with them. Sir Ernest Shackleton had to advance with the unaided efforts of man alone. His party started on the second phase with full loads, and achieved what is probably the maximum that could be accomplished under such circumstances. Amundsen was able to use dogs because of the more or less favorable conditions which he encountered. Perhaps to that fortunate circumstance his success may to large measure be attributed. But even if ponies, dogs or motor sledges can be used, it must be remembered that the last phase of the journey, owing to the height of the plateau, must inevitably be accomplished under climatic conditions which for severity are unequaled either in the Arctic or Antarctic regions. Polar exploration must be conducted with a technique of its own, a technique that differs at both extremities of the earth for the simple reason that the topographical conditions are not the same. In the north we find islands and a polar sea. In the south an austral continent surrounded by an enormous floating ice cap which is called the Great Barrier and which covers probably more than 150,000 square miles of the Antarctic Ocean. Sledging is, of course, necessary in both regions. In the north it is not possible to travel by sledge over the frozen sea except during a short period in spring. In the south sledging is more or less possible at all seasons, except that the meteorological conditions are more favorable at some times than at others.

The Importance of Equipment

Next to the personality of the leader, equipment is the most important element in the success of polar exploration. The Japanese expedition under Lieut. Shirase failed because of its poor outfit. Amundsen was not equipped nearly so well as Scott. Personal courage and will counted for more in his

The South Pole lies on a lofty eminence. How it was attained by Amundsen on December 16th, 1911, and by Scott on January 18th, 1912, is indicated on this map, together with Shackleton's course in 1909.

Amundsen's dog teams and sleds plodding along toward the Pole. This picture was taken by Amundsen only a few miles from his goal.

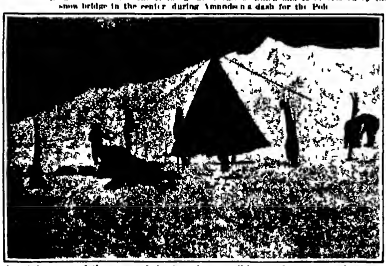
Photograph of Lieut. Helmer Hansen taken by Capt. Amundsen at the South Pole with one of the dog teams.

case than anything else. Lieut. Filchner, the head of the German expedition now in the South Polar regions, conducted his undertaking with true German deliberateness. First he carried out an elaborate campaign of oceanographic work out in the South Atlantic, and then a series of very interesting meteorological observations with sounding balloons in South Georgia. Finally, on the 10th of December, 1911, his ship the "Deutschland" set sail for Antarctica, where he expects to remain until the winter, that is the southern summer 1913-14. The "Deutschland" is equipped with wireless.

It may be that Lieut. Filchner's expedition is better equipped than that which Capt. Scott led. On the other hand, we are informed that Scott spared no time, energy or money in order to fit out his part. By popular subscription the sum of $200,000 was raised. He selected for his ship the "Terra Nova," the largest and the strongest of the old Scottish whalers. Built at Dundee in 1884, she is 187 feet in length and 31½ feet in beam, and is considered the best ship ever launched for the Greenland whale trade. Of late years, because of a decline in the whaling business, she has been engaged in seal hunting in the northern waters, sailing from St. Johns, Newfoundland.

The "Terra Nova," however, has not confined herself to the humdrum of trading. In 1903 she was purchased by the Admiralty as a relief ship for the "Discovery" expedition, and after being considerably strengthened she duly made her appearance in Ross Sea. The year 1905 saw her in the service of a North Polar expedition on a visit to Franz Josef Land. Thus she has ranged from the great ice barrier in the south to the North Polar pack—from extreme to extreme of the navigable waters of the globe. The size and strength of the ship make her a fitting receptacle for the extensive equipment which it is necessary she should carry for success.

In the foreground can be seen one of the great crevasses which had to be crossed by the snow bridge in the center during Amundsen's dash for the Pole.



Framheim, one of the camps of the Amundsen expedition used as a base of supplies.

Scott's Equipment.

In equipping his expedition Capt. Scott displayed painstaking care. He laid great stress on the fact that the newly devised motor sledges offered a new means of ice travel, and three such sledges were stored in the hold of the "Terra Nova," as well as an equal number of the more familiar dog sledges. In a final statement before the expedition started Capt. Scott thus summarized the difficulties of Antarctic travel:

"The problem of reaching the South Pole from a wintering station is purely one of transport. The distance to be covered there and back is about fifteen hundred miles. The time at the disposal of an explorer in a single season never exceeds one hundred and fifty traveling days. An average of ten miles a day can easily be maintained by men of good physique, provided adequate transport facilities are made.

"There are three means by which the traction for heavy sledge loads can be provided, viz. ponies, dogs, and motors. As a result of two years' experiments, a motor sledge has been evolved which has undergone satisfactory trials on the snows of Norway. A motor was recently taken on Mr. Shackleton's expedition, and it is instructive to note that it was found possible to run it in the lowest temperatures. Its use on a prolonged journey was prohibited only by the fact that its wheels were not sufficient to support it on the soft snow of the Barrier.

"The plan for the journey to the south pole from King Edward VII Land includes the use of the three means of sledge traction described. Ponies will be taken in sufficient numbers to insure a thoroughly adequate supply of food and will be used for transport to the foot of the glacier; a dog team with a relay of men will transport the loads over the glacier surface, and a picked party of men and dogs will make the final dash across the inland ice sheet. Motor sledges will be used according to their proved capacity as a main agency or useful auxiliary to the transport plan. If they reach the foot of the glacier there is little doubt that they will ascend it

The juncture of the Great Barrier and King Edward VII Land. The Barrier here appears about 300 feet in height.

One of the camps established by the Amundsen South Pole expedition on the way to the Pole.

On the way to the South Pole.

and greatly simplify the difficulties of the remaining journey. If they fail to reach the glacier they will, at least, as far as they will have taken relieve the ponies and dogs of the weights, and increase the safety of the return journey as they can be cached, when no longer available, to await the return of the party."

Scott's Programme

In a lecture delivered in London before his departure, Scott presented the following programme:

HOW CAPT. SCOTT MAPPED OUT AS FAR AS WAS POSSIBLE THE TIME TABLE OF THE BRITISH ANTARCTIC EXPEDITION

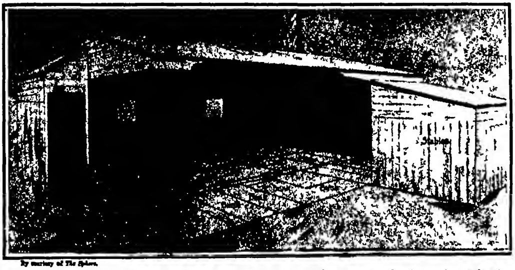
Departure from London	June 1st, 1910
Cardiff	June 15th 1910
Cape Town	August 1st 1910
Melbourne	September 11th, 1910
New Zealand	October 17th 1910
Leave New Zealand	end of November, 1910
McMurdo Sound	end of December 1910
Landing of winter hut and provisions of western party (twenty two to twenty five persons in number)	December 22nd 1910
Starting off of this party	about January 21st, 1911
King Edward's Land reached, if possible, early in	February, 1911
Establishment of second hut and traveling equipment for party of six men on King Edward's Land	February, 1911
Caches of provisions to be left on edge of Great Ice Barrier to form link between eastern and western parties	February 1911
"Terra Nova" to turn northward about	February 21st 1911
Investigation of the pack in the region of the Balleny Islands, and to proceed to the westward through or to the south of those Islands	March 1911
Depots laid well to the south on the Great Ice Barrier	April 1911
Start for the South Pole to be made during the month of	October 1911
Barrier to be traversed and the Beardmore Glacier ascended	during October and November 1911
Upper plateau to be reached	early in December 1911
South Pole to be reached if possible on December 22nd 1911	

Adverse conditions prevented him from living up to the schedule. He was delayed from four to six weeks in making the preparations for his polar dash.

Capt. Scott (seated) and his first officer, Lieut. Evans.

By courtesy of Black and London News.

Capt. R. F. Scott in polar costume.



By courtesy of The Sphere.

The hut in which the 1910 expedition lived after the ship landed them on the Antarctic continent

The internal arrangements are here only approximately given as the final divisions of the hut were settled on the Antarctic snows.

The Journey to the Pole.

Scott's actual start for the pole began on November 2nd, 1911, later than he expected. His plans and hopes were last described by himself, and the version was brought back by the "Terra Nova."

"The pony party consisting of myself with Wilson, Oates, Bowers, Cherrard, Atkinson, Wright, Evans, Crean and Keohane will start about November 1st. Independently of the success of the *motors*, ponies will be worked with light loads in easy marches to Corner Camp, with full loads and easy marches to One Ton Camp and with such pressure as necessary thereafter. Dog teams starting will rejoin us at One Ton Camp and help to advance loads. By these means we hope to get thirty units of food to the foot of Beardmore Glacier, a unit being a week's provision for four men. Then with three divisions of four men and twenty-one units of provisions, I hope to extend the advance to the required distance if the weather conditions are not wholly unfavorable.

Of the ten remaining ponies one is unreliable and one doubtful, the remainder being in very fine form. Officers and men are in splendid health and eager to go forward. Owing to my decision to postpone there is an obvious chance that the most advanced southerly party will be unable to reach the Terra Nova before she is forced to quit the Sound. Under these conditions, having regard to important scientific work done and facilities offered for further work, I have decided to maintain the station for a second year. The majority of the shore party will probably remain, but details depend upon the date of our returning from our journey, on home news and the extent of fresh transport provided."

On November 24th Capt. Scott wrote that the party arrived at Corner Camp. Just before One Ton Camp was reached the dog sled party caught up with Capt. Scott's party and they journeyed in company. They passed the abandoned motor sleds, and when they found the motor party waiting at latitude 80½ they learned the motors had been left behind because of the overheating of the air-cooled engines.

Capt. Scott, on January 3rd, 1912, when he was one hundred and fifty miles from his goal, wrote of his plans in a message he sent back. He said:

"I am going forward with a party of five men, sending three back under Lieut. Evans with this note. The names and descriptions of the advance party are: Capt. Scott, R. N.; Dr. Wilson, chief of the scientific staff; Capt. Oates, Inniskillen Dragoons, in charge of the ponies; Lieut. Bowers, Royal Indian Marine, commissariat officer; Petty Officer Evans, R. N., in charge of sledges and equipment.

"The advance party goes forward with a month's provisions and the prospects of success seem good, providing the weather holds and no unforeseen obstacles arise."

The Tragic End.

Capt. Scott and the four men with him reached the pole on January 18th, 1912, but on the return journey all perished. Their bodies were not found until a searching party sent out on October 30th discovered them on November 12th, nearly eight months after the disaster, in latitude 79 degrees 40 minutes south and longitude 169 degrees 23 minutes east. Evans died from concussion of the brain on February 17th, 1912. Oates from exposure on March 17th, 1912. The remaining three men made their way back to within 155 miles of Cape Evans, when they were caught in a blizzard that must have lasted nine days, and were overcome about March 29th within eleven miles of the shelter and supplies at One Ton Camp.

The relief expedition recovered the records of Scott. He had found the tent and documents left by Capt. Amundsen when the Norwegian left the pole about a month earlier.

Scott's total distance to the pole and back was 1,842 statute miles.

The death of Capt. L. E. G. Oates of the Sixth Inniskillen Dragoons was heroic in every sense of the word. Despite his badly frostbitten feet and hands, he struggled on manfully. On March 16th his comrades knew that he was doomed. For weeks he had suffered intensely without complaint. No wonder that Scott wrote in his diary:

"He was a brave soul. He slept through the night hoping not to wake; but he awoke in the morning. It was blowing a blizzard. Oates said: 'I am just going outside and may be some time.' He went out into the blizzard and we have not seen him since."

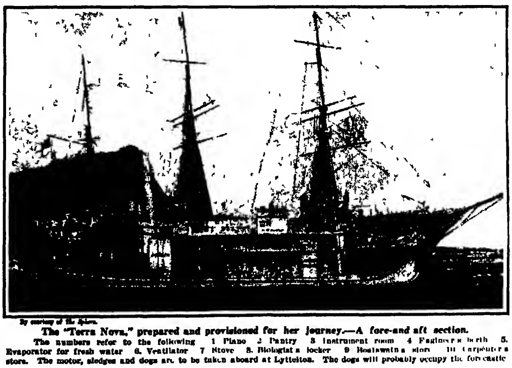
There is only one construction to be placed upon this passage. Oates knew that he could not live; he knew that as a sick man he was an impediment and the chances for the survival of the rest were better with himself out of the way. Bravely he stepped out of the tent and into the blizzard never to be seen again.

In the last tent pitched by the party a final message by Scott himself was found. Written with the shadow of death upon him, its pathetic appeal has deeply moved the civilized world. We reprint it here from the columns of the New York *Times*.

Message to the Public.

"The causes of this disaster are not due to faulty organizations, but to misfortune in all the risks which had to be undertaken. One, the loss of pony transport in March, 1911, obliged me to start later than I had intended and obliged the limits of stuff transported to be narrowed. The weather throughout the outward journey and especially the long gale in 83 degrees south stopped us. The soft snow in the lower reaches of the glacier again reduced the pace.

"We fought these untoward events with will and conquered, but it ate into our provisions reserve. Every detail of our food supplies, clothing and depots made on the interior ice sheet and on that long stretch of 700 miles to the pole and back worked out to perfection. The advance party would



By courtesy of The Sphere.

The "Terra Nova," prepared and provisioned for her journey.—A fore-and-aft section.

The numbers refer to the following: 1. Piano. 2. Pantry. 3. Instrument room. 4. Engineer's berth. 5. Evaporator for fresh water. 6. Ventilator. 7. Stove. 8. Biologist's locker. 9. Boatswain's store. 10. Carpenter's store. The motor, sledges and dogs are to be taken aboard at Lyttelton. The dogs will probably occupy the forecastle.

have returned to the glacier in fine form and with a surplus of food but for the astonishing failure of the man whom we had least expected to fail. Seaman Edgar Evans was thought to be the strongest man of the party and Beardmore Glacier is not difficult in fine weather. But on our return we did not get a single completely fine day. This with a sick companion enormously increased our anxieties. I have said elsewhere that we got into frightfully rough ice and Edgar Evans received a concussion of the brain. He died a natural death but left us a shaken party with the season unduly advanced.

But all the facts above enumerated were as nothing to the surprise which awaited us at the Barrier. I maintain that our arrangements for returning were quite adequate and that no one in the world would have done better in the weather which we encountered at this time of the year. On the summit in latitude 85 degrees to 86 degrees, we had minus twenty to minus thirty. On the Barrier in latitude 82 degrees 10,000 feet lower we had minus thirty in the day and minus forty-seven at night pretty regularly with a continuous headwind during our day marches.

These circumstances came on very suddenly and our wreck is certainly due to this sudden advent of severe weather which does not seem to have any satisfactory cause.

I do not think human beings ever came through such a month as we have come through and we should have got through in spite of the weather but for the sickening of a second companion, Capt. Oates, and a shortage of fuel in our depots for which I cannot account and finally but for the storm which has fallen on us within eleven miles of the depot at which we hoped to secure the final supplies. Surely misfortune could scarcely have exceeded this last blow!

We arrived within eleven miles of our old One Ton Camp with fuel for one hot meal and food for two days. For four days we have been unable to leave the tent, the gale blowing about us. We are weak.

Writing is difficult, but for my own sake I do not regret this journey which has shown that Englishmen can endure hardships, help one another and meet death with as great a fortitude as ever in the past. We took risks. We knew we took them. Things have come out against us, and therefore we have no cause for complaint but bow to the will of Providence, determined still to do our best to the last.

But if we have been willing to give our lives to this enterprise which is for the honour of our country I appeal to our countrymen to see that those who depend on us are properly cared for. Had we lived I should have had a tale to tell of the hardihood, endurance and courage of my companions which would have stirred the heart of every Englishman.

These rough notes and our dead bodies must tell the tale but surely surely a great rich country like ours will see that those who are dependent on us are properly provided for. (Signed) R. Scott

March 25th 1912

Campbell's Expedition and Its Relief

An expedition under Lieut. W. A. E. Campbell which had been sent to make geological investigations to the east of Cape Evans, also passed through perilous experiences, but returned safe and well. The "Terra Nova" had been unable to take the men off the year before on account of ice and they were compelled to spend another winter in the Antarctic. In this party were Dr. Levick, Priestly, Abott, Browning and Dickason. A gallant attempt to relieve Lieut. Campbell was made in April but the relief party was stopped by open water. Campbell and his companions were eventually rescued by the very searching party that found the body of Scott.

The escape of Lieut. Campbell and his northern party was miraculous. The men existed in absolute darkness except for the faint gleam of a seal blubber lamp. The supply of provisions was soon exhausted and thenceforward they had to live entirely on seal meat and to endure extraordinary hardships.

The Condition of Amundsen and Scott Contrasted.

Amundsen and Scott must have passed each other in the Antarctic some time during Christmas week, 1911. Amundsen rejoicing in his victory was speeding away from the Pole with good fortune attending each day's journey. Scott still hopeful, was forging stubbornly toward his goal passing from the 86th to the 87th parallel and disposing his records and supplies so that when the last auxiliary detachment of his party started back under the guidance of Lieut. Evans he would be ready for the final dash. Scott and Amundsen must have been near each other on December 28th 1911 when they were a little more than 200 miles from the Pole and about 150 miles apart. At the rate of Amundsen's returning speed he could easily have crossed the intervening ice and snow and met Scott in less than five days traveling.

Contrast Amundsen's return journey with that of Scott's. Here is Amundsen's account:

> On the return journey we had not a single day's rest. We did not even rest on Christmas day but passed on day after day through all weathers. There was little that was adventurous about the trip. But it was very hard work.

He suffered no privations, for he tells us:

> Of real hardships in the way of food on the pole journey there were none. Rather the reverse, for when my companions reached the ship they were almost fat and could not eat as much as when they started. The dogs, too, were fat and that they had lived well during the last part of the journey was shown by the fact that they would hardly touch the seal meat which was lying in large quantities about the base camp.

Amundsen had full rations all the way, but in that ultimate full rations are a very different thing from having as much as a man can eat. "There seemed little limit to one's eating powers when doing a hard sledging journey," says Amundsen. "However, on the return journey we had not merely full rations, but as much as we could eat from the depots, after passing 80 degrees."

Although Scott himself, Shackleton and Amundsen had all made extensive researches in the vicinity of the South Pole much still remains to be done.

The Scott Expedition, 1901 to 1904, discovered what is now known as King Edward VII Land, extending east of the Great Barrier from 152 degrees to 157 degrees east longitude. Following the Great Barrier to 82 degrees 17 minutes south Scott ascended the glacial covering to the overlying plateau, and after a journey of 300 miles reached an elevation of over 9 000 feet, a point in 77 degrees 30 minutes south and 147 degrees east longitude.

Shackleton's Expedition.

Shackleton's Expedition of 1907 to 1909 penetrated at the same place that Scott had previously entered, and proceeded up the western border of the ice field along the route which Scott had pursued. Shackleton thus reached a great glacier named Beardmore Glacier, coming down from the highlands to the westward. In 127 days Shackleton and his parties traveled 1,755 miles, reaching on January 9th, 1909, a glacier-covered plateau about 11,000 feet above the ocean in 88 degrees 23 minutes south latitude at 162 degrees west longitude within ninety seven miles of the Pole. In extent and importance the discoveries made by Shackleton have not been surpassed by any other single expedition. Perhaps the most interesting discovery made by Scott was that coal existed in large quantities in the Antarctic continent—unmistakable evidence that a land now frigid and barren once bloomed in tropical luxuriance. While Shackleton's journey to the Pole was in progress one party of the expedition climbed Mount Erebus and another reached the south magnetic pole and located it in 72 degrees 25 minutes south and 155 degrees 16 minutes east longitude in a position forty miles distant from the point deduced by the first expedition of Scott.

Amundsen's Contribution to Polar Geography

Despite all the haste with which he proceeded, Amundsen made important additions to our knowledge of the Antarctic continent, particularly in that sector of the earth's surface extending from the South Pole to the eightieth degree parallel of latitude between the meridians 100 degrees and 180 degrees west of Greenwich. He rather confirmed the view that the Pacific Ocean must be bounded on the south by a coast of the "Pacific type" the main characteristic of which is that the trend is determined by mountain ranges running parallel to the shore. The type is well exemplified in New Zealand on one side and by the Andes of South America on the other.

Amundsen's Antarctic venture came as a great surprise to the world. He left Norway in June, 1910, in the "Fram" seemingly with the intention of sailing around Cape Horn and through the Pacific Ocean and then Bering Sea into the Arctic Ocean. Upon rounding Cape Horn however he sailed to the westward across the South Pacific and made a landing at Whale Bay on the ice sheet covering Ross Sea. This place is in King Edward VII Land, near the eastern end of the ice front and opposite that point on Ross Sea from which Scott and Shackleton made their successful entrances into the interior. In less than a month the southbound expedition had cleared that vast plain of floating ice which flows down from the great mountains of the interior and covers the southern part of Ross Sea, throughout an area of 20 000 square miles, with an ice sheet approximately 800 feet in thickness. By a series of wonderful marches Amundsen reached the South Pole on December 16th, 1911. He followed the 164th meridian (west) to a mountain range in about 85 degrees south latitude. Here his party crossed Devil's Glacier between mountain peaks about 15,000 feet high. The glacier led to the South Pole plateau, about 10 500 feet elevation entirely ice covered. The route developed was new and independent.

Naturally one cannot help comparing Scott with Amundsen. There was a marked difference in their immediate motives. Unquestionably the attainment of the South Pole was the primary object of Amundsen's undertaking in the Antarctic, though, as we have previously pointed out editorially, this broad minded leader did not consult his own taste in the matter. He made a deliberate concession to popular ideals for the purpose of winning financial support toward an enterprise that did not, in itself, strongly appeal to the public—namely, his proposed five years' drift across the North Polar basin. Similar devious means to philosophic ends have often been resorted to by scientific men.

Not for many months will we learn anything really definite of the scientific results attained by the Scott expedition that terminated so tragically. Enough evidence is at hand to warrant us in stating that one of the auxiliary parties, at least, conducted researches that are invaluable, and that will illuminate the dark subjects of Antarctic meteorology, geology, oceanography, geography, and biology. Indeed, there is every reason to believe that from a scientific point of view the Scott expedition was even more brilliantly successful than that led by Shackleton.

One-man Broadside Control

VICE-ADMIRAL SIR PERCY SCOTT, the famous gunnery expert, has invented, and the British Admiralty, after long and severe trial, has adopted an apparatus for improving naval gunnery, by which astonishing results have been attained. The gear, known as a "fire director" was fitted in the super-dreadnought "Thunderer," armed with ten 13.5-inch guns, and this vessel carried out a series of comparative trials with a sister ship, the "Orion," fitted with the "fire control" system previously in general use. Firing in rough weather at a range of 10,000 yards, at an ordinary battle-practice target (90 feet long and 30 feet high) the most extraordinary results were obtained, the "Thunderer" making four times as many hits as the "Orion," the average of the former vessel being eighty per cent of hits to rounds fired. The tests were carried out in the presence of a large committee of naval officers, including Rear-Admiral Peirse, an ex inspector of Target Practice, Rear Admiral Browning, the present inspector, and a large staff of specially selected naval gunnery experts. As a result of the tests it has been decided to fit the apparatus to all ships of the dreadnought type at an estimated cost of $2,500,000, while the inventor of the system has been honored with a baronetcy.

The greatest precautions have been taken by the British Admiralty to prevent the details of the new system from being made public, and this is very significant when it is recalled that all previous inventions of Sir Percy Scott have been patented, and, therefore, published. In its essential features, however, the "fire director" resembles a similar apparatus which was in use in the muzzle-loading era, when many of the battleships which were built carried from six to a dozen heavy guns of the same caliber. This was invented by Capt. Moorsom, of the British Navy, and, to quote from a work on "Naval Gunnery," by Capt. Garbett, was an apparatus "by means of which the bearing and distance of the target and the heel of the firing ship were all determined, and the guns laid accordingly, it was generally fixed on the upper deck, over the center main deck gun, or other convenient position, and the signal or order to fire was given by the officer attending it as soon as he found the object coming on with his sights." Many scientific and mechanical advances have, of course, been made since this apparatus was invented in 1850. Instead of the officer in charge of the director passing along directions to the captains of the guns by word of mouth, he directs the guns himself electrically under Admiral Scott's system, and instead of giving an order or signal to fire," he fires himself by pressing a button and completing a circuit. All that the guns' crews have to do is to clean out the guns after each round and to load them for the next.

It has been stated that the "Thunderer" while undergoing the tests, fired several concentrated and simultaneous broadsides. It is understood, however, that the Scott apparatus is such that there is a momentary interval of time between the firing of each pair of turret guns, so that the structure of the ship is not called upon to bear the absolutely simultaneous discharge of ten guns, each with a muzzle-energy of 69,000 foot tons.

The fire-director is situated in an elevated position on the foremast as in the case of the fire control apparatus. The obvious drawback to the system is that if one shot misses the whole must miss, but on the other hand, if one strikes home nine others, or as many others as there may be on the broadside, strike home as well, and the ship has not yet been built which could stand the attack of ten 1,250-pound shells simultaneously. The thorough tests carried out by the British Admiralty show that four out of every five broadsides can be depended on to reach the target.

The Current Supplement

IN the current issue, No. 1938, of the SUPPLEMENT, R. H. Reid discusses the advantages of the heavy-oil engine for marine service.—H. T. Kalmus points out the important relation of research to the conservation of our natural resources.—L. C. Talmage, in an illustrated article, describes the extensive harbor developments of Texas City.—Suspicion has become centered on the stable fly as the chief carrier of infantile paralysis, according to a paper by Mr. C. T. Brues.—The snares and pitfalls of "beauty doctoring" are laid bare by Dr. H. Greeley.—This issue brings an important article by H. F. Smith on the chemical and mechanical aspects of the manufacture of producer gas.—Capt. W. I. Chambers call our attention to the importance of a National Aerodynamic Laboratory for the United States.—Spices are not merely useless luxuries or even mere appetite-stimulants—they have antiseptic properties, as has been shown by Hoffman and Evans.

Ready to descend in a diving helmet

Painting the Wonders Under the Sea

An Artist Who Works Under Water

By Charles M Carroll

MR. Z. H. PRITCHARD an artist now working in California devotes his life to painting pictures under water. He holds that it is impossible to catch the colors and what might be called the atmosphere of submarine scenery by any method of observation from the surface. Even when the disturbing effect of the broken surface of the water is eliminated by using a glass-bottomed boat or tube everything appears unnatural and distorted to the beholder. Mr. Pritchard goes down to the bottom of the ocean wearing a diver's helmet, and makes sketches on waterproof paper with waterproof crayons. The paintings are then completed in his studio.

Mr. Pritchard is an Englishman by birth. When still a boy he made for himself a pair of water-tight goggles, similar to those worn by the famous pearl divers of the South Seas. These goggles are merely bits of cow horn cut and shaped to fit the eyes. They allow a small space of air between the eyes and the water so that one can see very well. With these goggles the young man studied the landscapes under water with a clear vision. His imagination had been fired by Jules Verne's "Twenty Thousand Leagues Under the Sea," but he speedily discovered that it was impossible to shoot birds from the sea bottom as Verne asserted, as the sky is rarely glimpsed by the diver and then only by looking directly upward, for at a moderate angle the surface becomes a gigantic silver mirror reflecting the silent cities of coral and the lone, grotesque figure of the diver.

Mr. Pritchard became a decorator in England and a very successful one. He had preserved a few sketches made from memory of the scenes under water and showed them to some critics but when his fellow artists ridiculed his work he became discouraged.

About this time his health failed, and his doctors ordered him to go to Egypt. Instead he went to

Mr Pritchard ready for work when using the "diver's goggles," the latter shown suspended about his neck.

Coral-eating chaetodons, off Tahiti

Painting showing sand heaps on the bed of the sea.

Tahiti one of the South Sea Islands where he learned the most wonderful coral formations in the world were to be found. Arrived there he decided to take up actively the work of painting the under-water world.

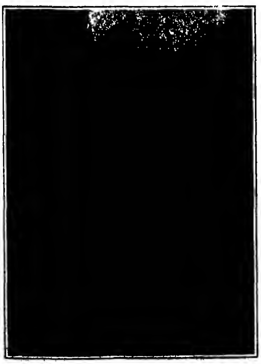
His process at first was comparatively crude. He would go out in his boat with his helpers, find his country with a glass-bottomed box and descend by means of weights hooked to his waist. Then he would make mental notes of the rock or coral formations, ascend and paint them. But this method proved unsatisfactory. He wanted to make actual sketches under the water.

After seemingly endless experimenting he discovered a way of making waterproof paper by soaking extra heavy drawing paper in cocoanut oil and draining off the surplus. This after drying proved to be a good working surface. Mr. Pritchard fastened it to plate glass which served as his drawing board by means of surgeon's tape in order that the water might not ooze under the paper and wrinkle it. He used Raffaelli crayons, semi-solid oil paints which are especially adapted to submarine painting.

After putting on his diving dress and goggles, he would take a good breath and lower himself down in the water using a heavy lump of coral attached to his belt by means of a hook to keep him down. Arrived at the bottom he would sketch from 30 to 45 seconds then unfasten the piece of coral and ascend for breath. The coral was then drawn up by means of a rope for another descent. In this way he was able to complete his sketch after a number of descents. Nowadays he uses a diver's helmet and is able to complete his sketch in one descent.

Thus he works, clad in his clumsy diving suit sitting on a rock and surrounded by the wonderful tropical fish. Of these fish Mr. Pritchard is enthusiastic. He tells of many varieties, from some so tiny that many of them together can be carried on his thumb nail to huge monsters that drift silently and ominously past. There are the bizarre coral-eating chaetodons, the

(Continued on page 18)



Coral formations in the South Sea, the most wonderful in the world.

A rocky gorge in 40 feet of water, off the west coast of Scotland.

A submarine "grove" of polyps, from a landscape study under water

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Safety Lathe Dog

THE accompanying engraving shows two forms of lathe dogs one the common form and another the improved form adapted to avoid danger of injury to the operator of the lathe In the common form of lathe dog the set screw is disposed on the opposite side of the eye from the arm that engages the face plate With this construction there is always the danger to the operator of being struck by the sharp edges of the head of the set screw or by the projecting arm of the dog In the improved form of lathe dog, this danger is avoided by having the arm curved around toward the set screw so as to serve as a shield for it Thus it will prevent the sleeve or clothing of an operator from being caught by the set screw and even if the operator's hand is struck by the arm, the blow will be more in the nature of a push, owing to the curved form of the arm.

Safety lathe dog

Waste Steam Detector

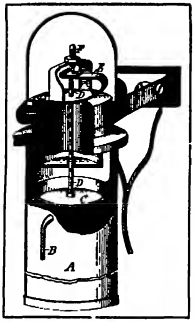
A GREAT many firemen on locomotives labor under the impression that the hotter they keep their fires the better firemen they are Hence they force their steam up to such a pressure as to keep the safety valve constantly popping or blowing off not realizing that the steam which pours out represents an actual waste of water and fuel It is calculated that it takes a quarter of a pound of coal to produce the amount of steam that escapes through a valve three and a half inches in diameter for each second of such escapement This amounts to fifteen pounds of coal per minute or approximately half a ton of coal per hour With larger safety valves the weight will be proportionately greater

Heretofore there has been no way of determining how much fuel is wasted in a given time in the operation of an engine, but an inventor has recently designed a device which keeps a record of the time during which the safety valve is blowing off The recording device is kept locked so that it cannot be tampered with and at the end of a run an inspector can unlock the device and determine the exact number of minutes during which the steam was blowing off The inventor claims that from experiments so far made by the use of his device a waste of an average of over two tons of coal has been saved in a ten ton run

The device is attached to the casing of the safety valve as shown in the engraving It consists of a clock mechanism with two concentric, graduated circles, one for the minute hand and one for the hour hand The circle for the minute hand is not only divided into minutes, but it is also marked with the equivalent in the pounds of coal of the steam wasted during the corresponding periods of time Similarly the circle for the hour hand is marked off with the equivalent loss in tons of coal A lever mounted on the device carries, at one end a brush which is adapted to engage the escape wheel of the clock mechanism while a broad blade on the other end rests on the perforated top of the safety valve casing When the valve blows off the steam hits this blade drawing the brush out of contact with the escape wheel and permitting the clock mechanism to run

At the start of a run the instructor sets the clock hand to 12 o'clock and then locks the casing of the clock. At the end of the locomotive run he can determine at a glance the length of time that the safety valve had blown off during the run, and also the equivalent amount of coal that has been wasted by the fireman.

Device for recording the "poppings" of a safety valve.



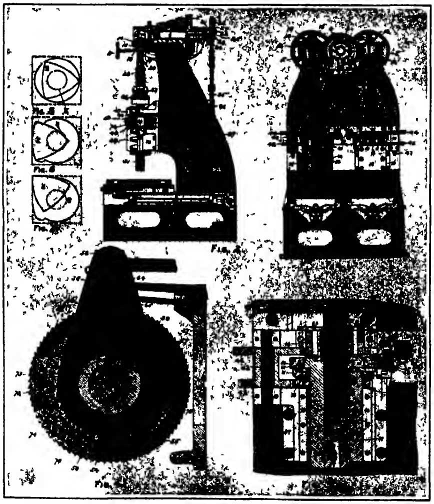
Fire alarm operated by variation of temperature.

A Novel Coaster

A CORRESPONDENT writes that in his city they have smooth asphalt streets and many hills adapted for coasting. Recently the boys have produced, in large numbers, home-made coasters consisting of narrow boards about 4 feet by 2 feet by 2 feet to 3 feet, to the under side of which near each end are fixed one pair of the rollers from a roller skate. On the front of this bar is secured a small packing box extending up about ten or twelve inches, and on top of this is secured a bar which projects laterally at both sides to form a handle. By this, when momentum is once acquired, the vehicle is stabilized so it will maintain its upright position just like a bicycle. Naturally the box obstructs the view of the roadway, and it is believed the idea can be developed into a neat device that can be cheaply produced and should prove a popular and profitable toy.

An Automatic Fire Alarm

THE earliest automatic fire alarms are virtually thermometers arranged to close an electric circuit when a dangerously high temperature was reached. The objection to this form of alarm lies in the fact that it is liable to be operated where there is no fire, as by an accumulation of heat in some badly ventilated spot, or again, it may fail to operate where there is a fire until the fire has gained considerable headway, merely because the temperature at the particular point where the automatic device is located may not happen to rise to the point for which the device was set. The apparatus shown in the accompanying drawing overcomes this difficulty It operates to close an electric circuit when there is a sudden rise of heat In other words, it is not the degree but the variation of temperature that affects the apparatus, provided the variation is sudden The device consists of a metallic chamber A which forms an air reservoir In the side of this reservoir there is a small pipe B, which serves as an air vent Stretched across the upper end of the air reservoir is a diaphragm C which carries a stem D that bears against the leaf spring E forming one terminal of the electric alarm circuit The other terminal consists of the platinum pointed screw F Now in case of a sudden rise of temperature, the air in the chamber A is rapidly expanded so that it raises the terminal E into contact with the terminal F, closing the electric alarm circuit This may be a gong or an automatic sprinkling device In case of a gradual rise of temperature, the expanding air in the chamber A escapes fast enough through the tube B to prevent flexing the diaphragm C The apparatus is so sensitive that the heat of the hands when applied on the chamber A will cause the alarm to ring, and yet if the device be located above a kitchen range, the heat of the range will not cause the alarm to be set off However, if a piece of newspaper be set on fire on top of the range, the alarm will immediately be sounded.



This machine has been designed to meet the great demand for turning out automobile transmission gears quickly and cheaply There is a great demand in factories for a means whereby square, hexagonal, or other polygonal holes may be cut in the gears automatically, rapidly and with accuracy.

Recent Improvements in Machine Tools—III

THE recent enormous activity in the automobile industry has given rise to a great demand for transmission gears to be used on automobiles. There has consequently become a great demand in factories where there is a large output for this industry, for a means whereby square, hexagonal, octagonal or other polygonal holes may be cut in the gears, automatically, rapidly and with accuracy

A H Marsh of Jackson, Mich., has recently patented a machine which is adapted to cut such holes in gears, plates or other work.

As seen in Fig. 1, the machine is a duplex one, the same driving mechanism, including the cone pulley 3, pinion 4 and gears 5, serving to operate the two shafts 6. The

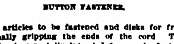
(Continued on page 185)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

FASTENER FOR BUTTONS AND OTHER ARTICLES.—O. D. BALL, 317 Fenimore St., Brooklyn, N. Y. The present invention is a fastener of the friction or tension type and involves a cord having looped engagement with



BUTTON FASTENER.

the articles to be fastened and disks for frictionally gripping the ends of the cord. The device is especially intended for use in fastening buttons to garments made of fur or any heavy fabric to which it may be applied without sewing.

SWEATER OR LIKE GARMENT.—B. I. CAMPE, care of Hecht & Campe, 377 Broadway, N. Y., N. Y. With sweaters having soft collars, as specified for the wearing of links engaging collar flaps, the links are liable to become disconnected from one or both collar flaps, and the collar has a tendency to curl or creep upward, and moreover, when ties are worn with the garment they are usually four in hands, or ties similar to these and the knot of the tie frequently sags, putting a strain on the link tending to pull the buttons of the links through the buttonholes. The invention overcomes all these drawbacks.

COMB AND BARRETTE.—J. A. BUALANDO, 3674 White Plains Ave., Williamsbridge, Bronx, N. Y. This inventor provides a co-operating comb and barrette, the latter being adapted to be held on the comb after the comb has been positioned on the head. The use of the co-operating comb and barrette prevents loss of the barrette or the comb since the parts are held in engagement with each other and also with the person's hair.

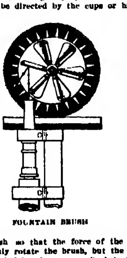
Electrical Devices.

SIGN AND INDICATOR.—P. FICCIO, 1015 Franklin St., Tampa, Fla. In order to indicate the direction in which a vehicle is about to turn, Mr. Ficcio has devised a sign or indicator which may be attached to the rear of a vehicle and which may be operated mechanically to project into view a slide bearing a legend or word showing the direction the vehicle is about to take.

ELECTRIC BELL.—A. LUNGER, care of Edwards & Co., 140th and Exterior Sts., Bronx, N. Y., N. Y. The object here is to so construct the parts in respect to the cover or casing that the cover will more effectually exclude dust, dirt and insects from the parts. By pivoting the hammer at a point closely adjacent the casing side wall through which the hammer extends, the opening in the wall may be made only slightly larger than the hammer, as the hammer will move an almost negligible distance at this point during its oscillation.

Of General Interest.

FOUNTAIN BRUSH.—R. VERNSKE, Tryon, N. C. The object here is to provide a rotary brush with cups or buckets at its sides which is mounted for rotating on a bracket having a clamp by which a nozzle of a standard hose may be secured to the bracket for directing water against the cups or buckets to rotate the brush, these being so proportioned that the water will be directed by the cups or buckets



FOUNTAIN BRUSH.

to the brush so that the force of the water will not only rotate the brush, but the water will be rotated by the cups or buckets to the brush to continue to supply the brush with fresh water.

COMBINED FIREARM AND SWORD.—J. CIMOCHI, 812 So. Main St., Shenandoah, Pa. This invention provides an instrument having co-acting members which may be used simultaneously or independently for offensive and defensive warfare. It also provides a structure on the grip of a sword and so arranges the same that the sword and the firearm may be used independently and that the end of the sword and one end of the guard may be used as sights for the firearm.

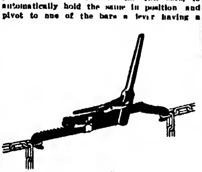
BRUSH.—A. G. CARLINO, 138 W. 64th St., Manhattan, N. Y., N. Y. This brush is provided with bristles for scrubbing and cleaning the hands and nails, and is also provided with a scraper whereby oil and grease may be effectually removed and thus permit effective operation of the bristles in thoroughly cleansing the skin and nails of the hand.

TICKET HOLDER.—H. P. IPSEN, 1490 Crotona Park E., Bronx, N. Y., N. Y. This invention relates to ticket holders and has for an object to provide a simple inexpensive and efficient device which will inclose the tickets for protecting the same but which may be readily ejected one ticket at a time whenever desired.

SECTIONAL DAM AND FLUME.—C. E. HOLMES, 170 River Front, Beaumont, Tex. This invention provides a dam and flume more especially designed for use in brooks and other small water ways for damming the water and for conducting it by the flume to a turbine or other motor and arranged to permit of conveniently placing the dam in position in the water way and to support the flume.

Hardware and Tools.

CLAMP.—C. E. SMITH and J. ROBERTSON, Dutchess Junction, N. Y. The several objects of this invention are attained by disposing two ratchet bars one above the other with a pinion connection between the two bars, to automatically hold the same in position and pivot to one of the bars a lever having a



CLAMP.

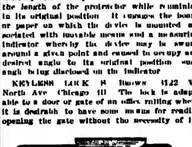
ratchet thereon adapted to fit one of the bars upon the other to be held by the first mentioned ratchet. The invention further disposes on the hook ends of each of the bars a removable facing plate to change the chain clamp into a carpenter's clamp.

PARALLEL PROTRACTOR.—J. I. EVANS, care of U. S. Surveyor General's Office, Reno, Nev. This invention furnishes improved means whereby any angle may be quickly and accurately found. It permits the protractor

PARALLEL PROTRACTOR.

to be adjusted for forming parallel extensions whereby lines may be drawn several times the length of the protractor while remaining in its original position. It engages the board or paper on which the device is mounted associated with movable means and a measuring indicator whereby the device may be swung around a given point and caused to occupy any desired angle to its original position, such angle being disclosed on the indicator.

KEYLESS LOCK.—S. BROWN, 3122 W. North Ave., Chicago, Ill. The lock is adaptable to a door or gate of an office railing where it is desirable to have some means for readily opening the gate without the necessity of inserting a key or working a combination. The



KEYLESS LOCK.

lock has a series of finger keys so arranged that by grasping them in a certain way the bolt will be actuated, but grasping them in any other way will lock the bolt and prevent its actuation.

SAFETY RAZOR.—L. KALTAS, care of Midget Mfg. Co., 178 Center St., N. Y., N. Y. This razor is adapted to be constructed of a size to permit the use of the same as a cuff button, and while the device may be described more particularly with relation to its function as a safety razor it is to be understood that one of a pair of these combined safety razors and cuff buttons may be made of a size and material adapted to be carried in the cuff, the other member of the pair being made to simulate the cuff button constructed as a razor.

COMBINATION DENTAL AND SURGICAL TOOL.—H. A. PARR, 500 Fifth Ave., Manhattan, N. Y., N. Y. This improvement provides a tool more especially designed for cutting superfluous flesh such for instance as grows over the wisdom tooth or other part in the mouth, and for readily slitting or cutting cap crowns preparatory to removing the same.

BEVELED DRILL SOCKET.—A. J. BOONE, care of F. J. Duden, 165 Broadway, New York, N. Y. The invention provides an improved structure designed to receive the shanks of drills regardless of whether or not the same have tangs associated therewith. A further provision is that of a tapering socket formed square or irregular in cross section for receiving a correspondingly shaped shank.

Household Utilities.

STOVEPIPE JOINT.—C. B. SISLER and J. M. DEAVENPORT, Pinkerville, Miss. The invention provides a joint to permit of the firm coupling of the pipe sections which will be particularly advantageous in the case of stovepipes running horizontally, the joint in such a case serving to make a self-supporting connection between the pipe sections that will prevent sagging or accidental disconnection of the sections.

APPARATUS FOR ROLLING TOWELS, NAPKINS AND THE LIKE.—P. G. MERRITT, 1031 Berlin St., New Orleans, La. The purpose here is to produce rolls containing a plurality of separate towels or napkins so constructed that they may be delivered or dispensed one at a time so that the withdrawal of one will result in the partial withdrawal of the next adjacent one in the roll leaving a free end projecting from the dispenser.

Prime Movers and Their Accessories.

ENGINE FEED WATER REGULATOR.—D. C. MOORE, Morrow, Ohio. The present invention is related with patents filed by Mr. Moore bearing Serial No. 509,175 and Serial No. 509,176 respectively. The invention provides simple and efficient means for regulating the length of stroke of a reciprocating pump connected with the water supply to conform with the working conditions of engine boilers and friction of the moving parts in the regulating mechanism is eliminated.

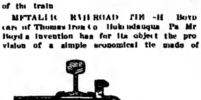
INTERNAL COMBUSTION ENGINE.—L. F. WANAGAN, care of Western Ice Machine Co., 128 W. 2nd St. South, Salt Lake City, Utah. This invention is adapted to use distillate and crude oil in obtaining power and it more particularly relates to an improved firing head. An object is to provide an engine with an improved firing head which will vaporize and ignite crude oil or distillate in a simple and efficient manner without danger of clogging.

CRANKING DEVICE.—R. D. CUMMINS, Middletown, N. Y. This device is arranged to utilize the power of a wound up spring of a spring motor to do the cranking to cause the engine after being started to wind up the spring of the motor and to automatically disconnect the cranking device from the engine shaft to permit the engine to run free of the cranking device and to have said device ready for restarting the engine when desired.

Railways and Their Accessories.

TRIPLE VALVE.—F. K. HUTCHINSON, 1705 So. 1st St., San Jose, Cal. This invention provides a triple valve with means to retard the release of the brakes, and the filling of the auxiliary reservoirs at the front of long trains so that on the rear cars the brakes will in all cases be released and the reservoirs will be recharged on or before the brakes are released and the reservoirs are recharged at the front of the train.

METALLIC RAILROAD TIE.—H. BOYD, care of Thomas Iron Co., Hokendauqua, Pa. Mr. Boyd's invention has for its object the provision of a simple economical tie made of



METALLIC RAILROAD-TIE.

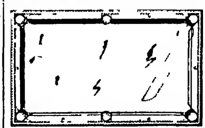
metal and having a maximum of strength for the material used. The construction is such as to provide special strength at the seat of the rail and a fastening device is provided which permits of applying or releasing the rail quickly and of locking the rail firmly to the tie.

RAIL ANCHOR.—J. W. ENRIGHT, 862 Tchoupitoulas St., New Orleans, La. The invention relates to a means for securing railway rails in place and particularly to securing rails from creeping and lateral displacement. This result is obtained by providing a baseplate with an overlying flange between which and the base of the rail a wedge is driven.

RAILROAD TIE.—C. YEADICKE, care of F. J. & J. T. Burns, Suite 7, Trust Bank Bldg., Kankakee, Ill. The invention provides an improved cross tie for railroad rails which is made of metal and for this reason has superior qualities of strength and endurance. The object of this invention is to improve the form and design of metallic ties so as to cheapen their construction and make them more stable and efficient in use.

Pertaining to Recreation.

POOL AND BILLIARD TABLE.—G. S. VAN DE WATER, care of Wallie Dorr Co., 16 Reade St., New York, N. Y. This invention relates



POOL AND BILLIARD TABLE.

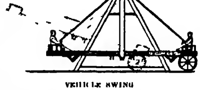
generally to pool and billiard tables and more particularly is directed to an improved cushion construction adapted to occupy different positions whereby the same table is convertible into a pool or billiard table. The principal object is to provide a cushion for use with pool or billiard tables, the said cushion being removably held in position, the improvement residing in the shape of the cushion whereby it may occupy different positions to close the pockets or leave them open, thereby providing either a pool or a billiard table. The illustration is a top plan view which pictures the cushions in position to form a pool table.

Pertaining to Vehicles.

SPRING WHEEL.—V. E. LANE, 288 Park St., Detroit, Mich. This invention relates to resilient wheels which are commonly employed on pleasure and commercial vehicles and among the objects aimed at in the present improvement is to construct a wheel neat in appearance, compact and practically dustproof with respect to movable parts.

TRACE HITCH.—T. J. JOHNSON, Box 38, Allentown, Pa., and J. C. ELLAS, Allentown, Pa. This invention provides a device adjustable to accommodate traces of various thicknesses, to increase the range of adjustment of the length of the traces and to facilitate the operation of fastening the traces in operative position.

VEHICLE SWING.—O. ZIMMERMAN, 6815 South Park Ave., Los Angeles, Cal. The object of the inventor is to provide a mechanical swing arranged to provide an exhilarating exercise and considerable amusement to young and old using the swing, to insure safety in the



VEHICLE SWING.

use of the vehicle swing and to guard against a tendency of producing dizziness of the user. For the purpose named use is made of a suspended link pivotally supporting at its lower end a supporting frame provided at one end with wheels and seats, the wheels being adapted to travel on the ground, on the floor or rails or other suitable support.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles

Where the Motor Bus Beats the Trolley

By J R. Eustis

WHILE the United States leads the world in the use of motor trucks, having more in service than any other two countries combined there is one type, the motor omnibus, in which England, France and Germany lead this country by a wide margin It is hard in fact, for us to really appreciate the extent of the motor bus service now provided in the cities of London Berlin, and Paris.

The largest company operating in London for example now has over 1 500 motor omnibuses in service This is the London General Omnibus Company and its installation of motor vehicles is the largest in the world. This company formerly owned 18,000 horses and over 2,000 horse-drawn buses, but these have now been entirely discarded

This company carried in the past year 210,300 000 passengers, or only about 25 per cent less than the 287 199 629 passengers who rode in the New York subway during the year ending last December The lack of a comprehensive system of surface electric cars in London, of course favors the use of motor omnibuses.

That the motor omnibus has decided advantages over the street car, and will largely displace the latter, is indicated by figures now available for both the London County Council and the London General Omnibus Company The former, operating tram lines under a $90 000 000 capitalization, obtains a route mileage per car of 120 miles per day while the latter, with $11,230 000 capital gets 170 miles per day For February of this year the bus companies' business showed an increase over the corresponding period of 1911 of 21 per cent, while the tram lines gained only 6 per cent The motor omnibuses are therefore, not only proving more popular with the traveling public, but evidently return larger dividends.

What Motor Trucks Have Saved for a Brewer

By Jean E. Blaise, General Superintendent of the Peter Doelger Brewing Co.

WE have sold every horse we owned, we let the last one go May 2nd 1912. Now even our ashes are disposed of by means of a motor truck

We bought our first 5-ton electric truck in 1904, merely as an experiment We did not buy again until 1909 when we bought three A few were purchased in 1910 and in the end of that year we became satisfied that with the improvements in truck design and our better knowledge of scientifically routing out deliveries, the motor truck was a paying business proposition Accordingly in 1911 we bought 35, the majority of them all 5-tons capacity and this year we have already purchased 20 more giving us about 60 electrics altogether Then of course we have 18 gasoline trucks for our extra long hauls.

We sold our first horse in the fall of 1910, and sold more and more as the trucks came into service We have sold 176 altogether as a direct result of installing motor trucks, and I know it has been a wise thing for us to do. We had the best horses and wagons that money could buy and good capable drivers who were with us for long periods, but the motor truck is the only thing for the up-to-date brewer At least for the one who realizes that money saved in distribution is as important as that saved in production We have reduced the cost of delivering beer in Greater New York from 35 cents per barrel to 15 cents per barrel, and this within from 8 to 10 miles from the brewery Our whole delivery system has been revolutionized, and in place of immense stables, we have a fine garage, which has saved us indirectly, half a million dollars in real estate alone.

We had a stable 200 feet wide fronting on East Fifty fifth Street, and back of it three wagon yards and some other buildings, used just for our horse equipment We tore down half of the stable, converting the rest of it to other uses, and built on the ground so released a big bottling plant. In one of the wagon yards we built a garage for our trucks, 85 by 100 feet, and this is all the ground necessary to house 100 trucks, because we only need five stories even for that. The long and short of it was, we were wasting about twenty-eight city lots worth from $15,000 to $20 000 each. And that isn't all the money we saved. In addition, the saving of from 18 cents to 20 cents per barrel on beer delivered, plus the saving on drivers, foots up to between $60,000 and $75,000 per year

We haven't completed nearly all our plans yet Inside of another year, we shall establish four depots in Greater New York, delivering the beer from the brewery to the depot with heavy trucks and distributing it from these centers with lighter power vehicles. By this method, we expect to operate electric trucks exclusively, as we believe electricity is going to supplant other forms of power in the industrial world. Year by year we drive more machinery and appliances in our brewery with electricity, and there are good reasons for doing this. Things reached a point where it cost us 96 cents per day to feed and care for each horse in our service We knew we had to find a solution for that expense or go out of business and that principle applies to other things as well Two men with salaries aggregating $.88 per week care for all our motor trucks, so you see the difference

Cost of Gasoline Truck Service

To the Editor of the SCIENTIFIC AMERICAN

In the SCIENTIFIC AMERICAN of January 18th, we note with considerable interest the article by Mr H W Perry entitled "Teams and Motor Trucks Compared." We beg to take exception to the figures he gives, as he assumes that full loads are always hauled both ways, which is very rarely the case It is very seldom that full loads are carried half the distance the truck travels.

You can readily realize that if the truck starts out with a load of merchandise and begins making deliveries, by the time it reaches its farthest point it will be empty and will return in that condition. With contractors full loads are often carried to destination and then the truck returns empty With breweries and allied industries full loads are often taken to one point and a load of "empties" brought back, and these are the people that generally have the greatest ton mileage

So you will see from this that it is not possible to figure out ton mileage unless the exact conditions are known. This term is often used, and very seldom is it used correctly We consider the cost per mile a much more reliable figure

We also notice "Cost Estimates of Horse and Motor Trucks" by Mr John Ritchie, Jr Our experience is only with a 5-ton gasoline truck, but the writer's experience has been with all the different sized machines from 2 tons to 10 tons capacity, and he has invariably found that a gasoline truck is much cheaper to operate at, say, over 24 miles a day, than is the electric of similar capacity working under the same conditions.

Mr. Ritchie refers to the tests made by

Classified Advertisements

the Massachusetts Institute of Technology. We have the Bulletin No 2 giving these tests, and averaging the figures they give in reference to five-ton trucks, and using the cost for current given us by the New York Edison Company and the cost for insurance rates we compiled the following table

Costs to be Considered in the Operation of a Pierce-Arrow Five ton Truck.

Fixed charges vary and so should be determined by each owner but the following list includes all the necessary items, some of which may be changed or left out

The operating charges are accurate and conservative. If truck receives the consideration it deserves they will be much less.

COST OF TRUCK COMPLETE WITH $300 BODY—$4 800

Interest @ 6%	$288 00
Insurance Fire @ 2¼%	108 00
($.894) Liability $5 000 one person $10 000 one accident	122 00
Property damage $1 000	48 80
Collision 2 2 5% ($25 deduct able coverage)	115 20
Garage @ $25 a month	300 00
Driver @ $21 a week	1 092 00
Helper @ $12 a week	624 00
Fixed charges per year	$2 698 00
Fixed charges per day (1/300 year)	9 00

	Per Mile
Tires (8 000 miles guaranteed for $480)	$0 0611
Gasoline (4½ miles per gal @ 17c)	0 0377
Lubrication (Motor 250 miles per gal @ 60c) (Transmission 5 000 M P G @ 65c) (rear axle 5 000 miles to 3½% gal @ 65c)	$0 0030
Repairs and overhaul (maintained and overhauled every 15 000 miles for $475)	0 0250
Depreciation (truck good for at least 150 000 miles and deducting cost of tires)	0 0287
Operating cost per mile	$0 1555

To find the cost for doing any work add the fixed charges to the product obtained by multiplying the miles run per day by the cost per mile

From this table you will see that it cost 18½ cents per mile to run a five-ton electric truck 24 miles a day and from the second table giving the cost for operating a five ton Pierce-Arrow truck you will find that it costs 53½ cents per mile with our machine to run the same distance

Cost of Operating a Five-ton Electric Truck

based on investigations made by the Electrical Engineering Department of the Massachusetts Institute of Technology. Several five ton electric trucks were carefully watched by them over a year and results recorded in their report dated October 1912. The insurance and current prices are New York city rates

COST OF TRUCK COMPLETE WITH $300 BODY—$4 000

Interest @ 6%	$240 00
Depreciation @ 10%	400 00
Insurance (all four kinds)	371 00
Garage @ $20 a month	240 00
Driver @ $18 a week	936 00
Helper @ $12 a week	624 00
Sundries	260 00
Fixed charges per year	$3 071 00
Fixed charges per day (1/300 year)	10 23

	Per Mile
Tires	$0 978
Current @ 4c K W H 40 K W H necessary for one charge for 30 miles	0 0533
Battery renewals	0 0528
Repairs, overhaul and painting	0 0378
Lubrication	0 013
Operating cost per mile	$0 2547

There is a great scarcity of data available for others than those in the electric vehicle manufacturing business showing what it costs to operate such machines, as it is generally assumed that the electric truck costs much less than does the gasoline truck. The electric vehicle manufacturers seem to be willing to let the matter stand as it now is, and we are doing our best to get the true figures, so more accurate comparisons can be made

ROBERT C. REID,
Harrolds Motor Car Company

"Comparing the Incomparable"

To the Editor of the SCIENTIFIC AMERICAN

I have been interested deeply in the articles upon motor trucking which ap-

pears in your issue of January 18th last. The pictures given on the front cover and on page 70 of this issue to accompany the articles by Messrs. Perry and Ritchie bring out in unique manner some of the comparative properties of motor trucks and horse-drawn wagons. But I do not believe the two comparisons are as discrepant as suggested in your editorial entitled "Comparing the Incomparable," and I desire to take this opportunity of pointing out wherein the view points of the articles differ

The article by Mr Perry considers only the 'possible" work by gasoline motors and by horse wagons. The daily mileage cited for horse wagons (16 to 20) is approximately what they are to-day travel ing in city services, the mileage of 40 to 60 per day as mentioned for motor trucks is being covered by those motors which are in comparatively long haul services, but is impossible by even high speed cars in a great portion of urban work. The services in which motors cover more than say 30 miles per day are admittedly too severe for horses, and most of them were not performed by road vehicles before the advent of the automobile A comparison of the cost of moving a ton over a mile under the two sets of circumstances is not logical, any more than it is logical to claim a superiority for the railroad which hauls between Chicago and New York at a lower ton mile operating cost than the road which hauls between New Haven and New York.

Instead of stating the possible performance of motor and horse wagons in entirely different services, it would seem desirable to consider their relative performances when used in the same service and under the same conditions. This was the basis of the data reported in Mr Ritchie's article As stated in the text particular services were selected for each size of wagon and the territory covered in each case was assumed to be within four miles of the loading points The results of comparing the horse, electric and gasoline wagons show that in this limited area the horse wagon is by no means out classed, particularly in the lighter capacities.

The reason for this deduction, which is referred to in your editorial as 'startling' is not hard to find It is the amount of standing time required by our present delivery methods, as horses are seldom moving more than 40 per cent of the working day The chief superiority of the motor truck over the horse wagon is the higher speed which is from two to three times that of the horse Thus, when the time taken in loading and discharging restricts the moving time of a motor to between 2 and 3½ hours per day the motor cannot travel any 60-mile distances. Particularly in retail deliveries is it difficult to reduce the standing time of a vehicle beyond certain limits as a large portion of this item is dependent upon the customer's convenience

Comparing motors and horses in this way is undoubtedly, as you suggest, like comparing a marathon runner with sprinters over a hundred yard dash ' But because the marathoner was defeated in such a match, who would claim that he was not well developed physically? Both he and the sprinter have their recognized places on the lists of a meet.

Just so with the horse, electric and gasoline wagons. A comparison of the three types of vehicles in a given service and under the same operating conditions shows one of the three to be superior In another service one of the other types might be superior, analysis only can tell. For the services cited in the report of the study by the Massachusetts Institute of Technology the electric truck was found to have advantages in point of cost. The Institute's study is intended to supply information by which the cost of performing a given service with each of the three types of vehicles can be compared. It is manifestly impossible to cover all classes of service in a single comparison.

Very respectfully yours,
H F Thomson, Research Associate,
Massachusetts Institute of Technology.

Painting the Wonders Under the Sea

(Concluded from page 178.)

resemble nothing so much as huge butterflies on the wing. Exquisite little fish noted for their curiosity of this strange creature in their world, and also for their almost unbelievably perfect and brilliant markings, crowd around him and swim between his fingers. The parrot fish are more dangerous, for their beaks, like those of our parrots, are sharp and strong, and if the fish is one of the larger species it can easily take a nip out of one's hand.

Under the water, says Mr. Pritchard, one seems to see rivers, lakes and water falls just as one does above the water. The gleaming sand, swept down by the action of the tides, furnishes this illusion. One of Mr. Pritchard's paintings of coral rocks gives the impression of a raging torrent, forcing its way between cliffs and dashing its spray up the sides of the rocks.

From sharks, octopi and swordfish there is, of course, danger. But Mr. Pritchard takes care never to descend in a spot where there is a notable absence of small fish, for that is a sure sign of danger. The most beautiful and bewildering sight of all, says the artist, is a school of fish darting by in a maze of reflected light, making the water quiver and scintillate and thrilling the silent watcher.

Mr. Pritchard's finest work has been done at Tahiti, but he has secured excellent subjects off Santa Barbara. According to the artist the coloring beneath the ocean is all in the lowest keys, merging from deep indigo and purple into the lighter delicate tints of pale greens, grays and yellows. Every point, every sharp edge shimmers like silver in the upper regions. Rocks and cliffs in the dim light assume an appearance of inconceivable size. On land we see the foundations of every object, no matter how large or small its bulk, but when one looks down into the depths of the huge coral formations under water they seem to be resting upon deep blue air.

Although he can work at any reasonable depth, Mr. Pritchard prefers about thirty feet, for there the light is clearer and at its best. He can remain under water when wearing a diving helmet over half an hour with perfect comfort.

Recent Improvements in Machine Tools

(Concluded from page 180.)

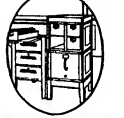
handles 11 permit the operator to slide the gears 5 into and out of mesh with the pinion 4 to start or stop.

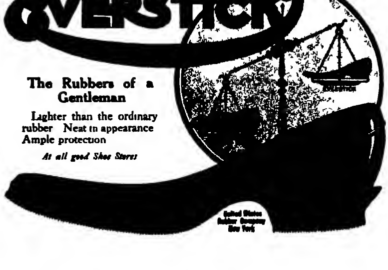
Each shaft 6 has two cranks, 12 and 21, the former, which operates the cutter, comprising a bolt 14 slidable in a T slot 11 in the shaft 6, positioned by the screw 16 and held by the sleeve 17, nut 10 and washer 18, the latter controlling the feed, consisting of the bolt 22 and sleeve crank pin 23 working in the slot 25 of the connecting rod 24. A screw 26 and block 27 limit the movement of the pin 23.

The connecting rod 30 connects the crank 12 with the cutter spindle 31, revolubly mounted in the knuckle 32, which is hinged to the adjusting turnbuckle 29 by the pin 33. The connecting rod 24 is adjustable as shown and connects the crank 21 with the feed connections. These consist of the bar 85, mounted to slide in the guide 86, and connected to the arm 87 of a bell-crank the arm 88 of which is connected by the rod 57 to the feed plate 56.

The cranks 12 and 21 are shown opposite for the sake of clearness, but are actually at an angle to each other.

The feeding mechanism is as follows. Projecting from the frame are the heads 37 with caps 38, in each of which is revoluble the outer eccentric sleeve 39, having a fixed gear collar 40. The last meshes with the idler gear 36 on the stud 63, and this meshes with the pinion 42 on the spool 43, mounted on the fixed shaft 41. A pinion 44 on the upper end of the spool 43 meshes with the gear 45 at the lower end of a sleeve 46, which is also revoluble in bearings 47 on the head 37.





The lower end of the driving sleeve 48 is revolubly supported in a depression in the upper end of the inner eccentric bushing 50, and is slidably connected to the spindle by the feather 49. At the upper end of the inner bushing is a ring 53 with oppositely extending ratchet teeth 54 and 55 which ring is secured to the flange 52. The feed plate 56, mounted just above the ring 53, has a pivoted block 58 connected to and reciprocated by the rod 57 and the crank 21, the stroke of this plate being determined by the screw 26. A plate 60 secured to the sleeve 48 by a screw 50, rides on the sleeve 40 and has a slot 61 containing the bolt 62, which engages the sleeve 46.

When the outer bushing 30 is turned, the gear 40 will turn the spool 43, and the sleeve 40 through the idler gear 36. The plate 60 thus acts as a crank of which the bolt 62 is the crank pin, so that the spindle will revolve at the same speed as the sleeve 40

The operation of cutting a square hole is shown in Figs 5, 6, and 7 A round hole is first drilled to admit the cutter 30 (Fig 5) which reciprocates up and down while being swung out to the position shown in Fig 6. The spindle 31 is then carried around a path 35 while it is turned in the opposite direction on its own axis, so that at the end of a proper number of strokes depending on the feed, the position shown in Fig 7 is reached

As will be seen the movement of the spindle is three-fold First, a lateral movement to get the required eccentricity—to carry its center to the path 35, second a movement in the path 35, and third, a reverse rotation on its own axis equal to the number of sides of the hole, divided by the number of sides of the cutter times a full revolution The last is caused by the turning of the outer bushing 30, and by means of the gears 40, 36, 42 44 and 45, the collars 40 and 48 and the plate 60 The second movement is also caused by the turning of the outer bushing 39 The first movement is caused by the turning of the inner bushing within the outer, and is accomplished as follows

A pin 64 carrying the spring held pawls 65 and 66, is mounted on the feed plate 56. The upper pawl engages the teeth 54 of the ring 53 so that as the plate reciprocates the inner bushing 50 will be turned. A stop 67 is secured to the ring 53 and a second stop 68 is mounted on the upper end of the outer bushing 30 When these two stops are in engagement, the spindle and outer bushing 30 will be concentric, the eccentricities of the two bushings being the same Turning the inner bushing within the outer will carry the spindle outward On the outer bushing is secured a worm gear 70, and around this worm gear is revoluble the ring 71 which has lugs 72 carrying the shaft 73, to which is secured the worm 74, which meshes with the worm gear The ring 71 carries a stop 75, which is in the path of the stop 67 Turning the shaft 73 of the worm 74 will position the stop 75 with reference to the stop 68, and thus limit the movement of the inner bushing within the outer As the feed plate reciprocates, the ring 53 and the inner bushing will turn, carrying the spindle outward until the stop 67 engages the stop 75 on the ring 71 As the ring 71 is locked to the outer bushing through the worm 74 and worm gear 70, any further turning of the inner bushing will cause the outer bushing to turn This results in first carrying the cutter from the position shown in Fig 5 to that in Fig. 6, and next, because of the common movement of both bushings, from the position in Fig. 6 to that in Fig. 7 At the same time, because of the gears 40, 36, 42, 44 and 45, the cutter turns back on its own axis one and one third of a revolution at each full revolution of the outer bushing.

To return the parts, the pawl 65 is disengaged when the eccentric bushing 50 can be readily turned back by hand until its stop 67 engages the stop 68 on the inner bushing.

The table 102 is constructed as shown so that the machine may be employed also as an ordinary slotting machine.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions books etc This will greatly facilitate answering your questions as in many cases they have to be referred to experts The full name and address should be given on every sheet No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request

(12749) W D A writes I take the liberty to make a correction in the answer to query No 12733 occurring in the issue of the SCIENTIFIC AMERICAN of January 25th in which F R asks why razors and other steel tools seem to lose their edge and when laid aside without sharpening seem to regain their original keenness. The theory regarding this is that the fine thin edge of steel forming the cutting edge of the tool is bent over in service and the tool becomes dull When we hone or strop this edge we bend it back into its original position and the tool is sharp once more If the tool is laid aside without honing or stropping this thin edge will gradually bend back of itself and the tool will be sharp again This is the phenomenon to which F R refers and is known as the elastic lag of steel It takes time however and is visible only under a fairly powerful microscope A We thank you for your suggestion of a different theory from the one we advanced regarding the belief that a razor can recover its edge by laying it away to rest. We have never met with any facts to show that a piece of steel or other metal in fact can bend itself back into shape after it has been bent beyond its limit of elasticity A razor edge or the edge of any other tool when turned over has been thus bent Elastic fatigue as it is usually designated does affect the time of recovery of a spring when not bent beyond its limit of elasticity But when this limit has been exceeded no force exists in a piece of metal to move it back again into its former shape We have never seen any references in scientific literature to support the theory which you advance and should be very thankful if you will give us the references to the authorities on this point upon which you base your statement We have many times examined the edges of razors under the microscope but never saw the recovery of the edge We are open to conviction and shall be glad to receive the references in question

(12750) F E V asks Will you kindly answer the following If a large tree located hundreds of miles from any living creature should be struck by lightning crash to the ground crushing many smaller trees in its downward path would it make any noise? The writer contends that although the sound waves would be set in motion there would be no sound unless they came in contact with an ear drum Is that correct? A Your query simply requires a definition of the word sound The dictionary gives two definitions One is a sensation the other is the physical definition which is used in all textbooks of physics and which is Such a rate of vibration as can affect the auditory nerve Sound the sensation cannot be produced excepting there is an auditory nerve to receive it and transmit it to the brain Sound the external cause of the sensation exists whether there is an auditory nerve in the vicinity or not Take your choice. Both definitions are correct There need be no controversy Most controversies would be soon settled if the parties determined the exact meaning of the terms employed in their discussions

(12751) R W asks A funnel shaped vessel 12 inches long 12 inches in diameter at the top and tapering to ¼ inch at the bottom is filled with water the top of the funnel being left open to the atmosphere The small end of the funnel is connected to a larger vessel in which the air has been extracted At what pressure would the water be discharged in the vacuum? A The case you send us is answered as follows The water will be discharged into the vacuum below with a pressure equal to the pressure of the atmosphere at the moment plus the weight of a column of water ¼ inch in diameter and 12 inches high The shape of the funnel does not affect the result Only the cylinder of water from the opening below to the top of the water is concerned in producing the pressure The principle is demonstrated in mechanics by what are called Pascal's Vases which are dishes of various shapes but all have the same sized bottom outlet and the same height or depth of water It is shown that the pressure in all at the bottom is the same. You will find these illustrated in almost any high school textbook of physics in your city library

(12752) C S asks B claims it is much easier for a person to swim in salt water meaning the ocean than in fresh water I claim the difference is too small to be noticed by the swimmer Will you please enlighten us on this subject? A It is much easier to float in salt water than in fresh water Hence it may be said to be easier to swim in salt water but a person must push his weight of water out of the way every time he moves his length in either case and thus the work done in swimming is the same in both salt water and fresh. Work is equal to the resistance times the distance the resistance is moved. In this case the resistance is the weight of water which is pushed out of the way by the swimmer Water equal to one half of the weight of the swimmer is pushed sidewise to a distance equal to one half the width of the swimmer on each side of the swimmer This gives the work done in swimming each time the swimmer moves his length.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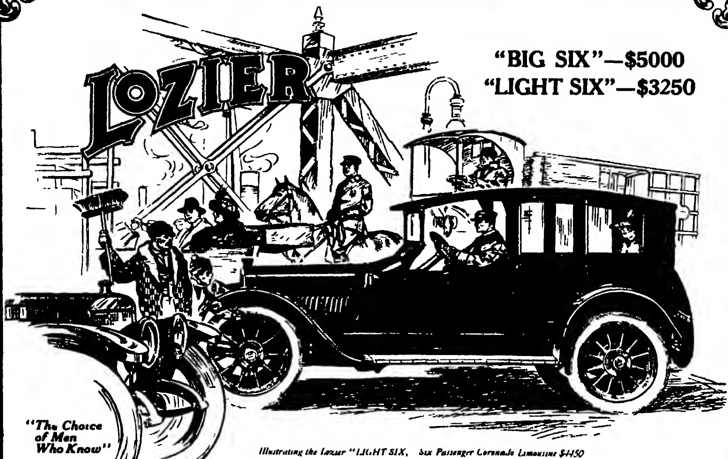

Illustrating the Lozier "LIGHT SIX," Six Passenger Coronado Limousine $4450

IN THIS, the sixth successful season of Lozier Sixes, even with Lozier production increased fourfold in its two great plants, there will not be enough Loziers to supply all those who want them. Every prediction made last fall has come true. Every forecast Lozier dealers made has worked out to the letter Therefore, those who expect to get their Loziers this year will do well to place their bona fide orders now, just as more than fifteen hundred purchasers have already done

To everyone who knows the automobile industry and the relative regard in which the several high-grade cars are held, there is nothing surprising about the sweeping success of Lozier this year

For eight years the Lozier has been the only American-built car that has commanded and still commands a price of $5000

For six years the Lozier has been the most talked-of six-cylinder car in the world

Up to the Fall of 1911 when, with the winning of the Vanderbilt Cup, Lozier withdrew from racing because it seemed that any further victories could add no higher honors and because the car had been brought to perfection by what racing had taught in years of grilling tests—up to that time every principal honor the American speedway could offer had come to Lozier

Year after year these victories came because the Lozier was built right A Lozier was never withdrawn from a race because of mechanical difficulties. Lozier strength, power, endurance and safety won these races, just as Lozier strength, power, endurance and safety have won the respect and admiration of all men who know motor cars.

And the Lozier continues to lead all American cars with no other builders sufficiently endowed with ideals and experience to combat its leadership

No wonder, then, that when the Lozier "LIGHT SIX a true Lozier for $3250 — was added to the line this year, thousands wanted this car Thousands who for years have wanted Loziers but did not feel they could afford to pay $5000 for one

No wonder that dealers all over the country telegraphed or came to Detroit to secure the Lozier agency No wonder that our branches in the principal cities received as many as fifty calls and letters in a single day asking them to arrange demonstrations

The Lozier "LIGHT SIX" has simply swept everything before it in the high grade field No other car commonly reputed to maintain similar high-grade standards of construction and service offers a Six at anywhere near the Lozier "LIGHT SIX" price at $3250

The Lozier "BIG SIX" will set a new record in the sale of $5000 cars—for men who know automobiles and can afford to take advantage of their knowledge are satisfied with nothing less than Lozier quality And Lozier quality in its entirety mechanical precision, power, luxury and comfort—is found only in Lozier cars

Lozier leadership was never so firmly established as it is today

LOZIER "LIGHT SIX"

Left side drive, center control—streamline body design, Electric Starting and Lighting System Touring and Runabout models $3250 Coupe $3850 Limousines $4450

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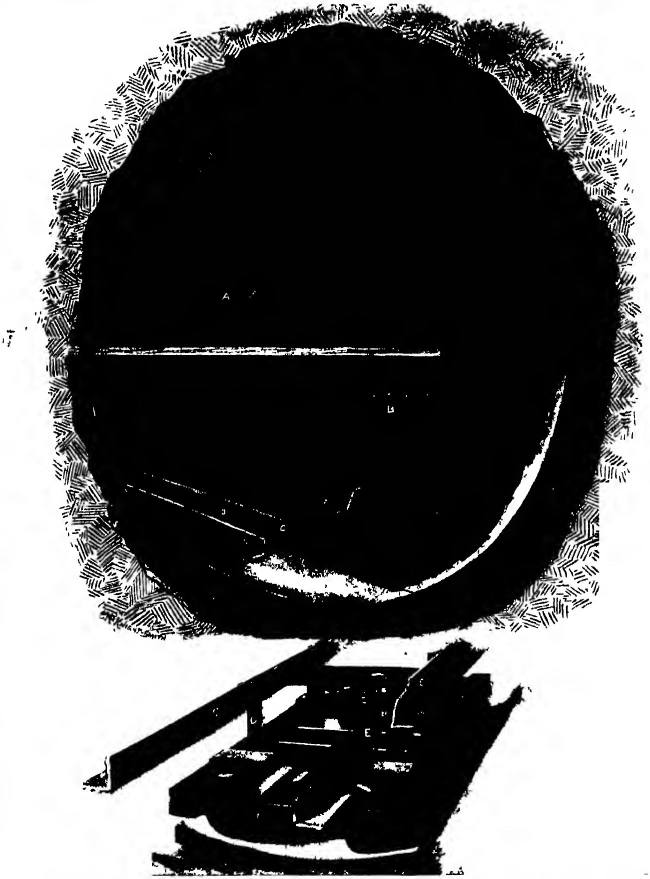

Steel forms used in lining the aqueduct with concrete. The forms are retracted from the lining after it is set, and moved forward on trucks.

SUPPLYING A METROPOLIS WITH MOUNTAIN WATER.—[See page 201.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly the world's progress in scientific knowledge and industrial achievement.

The Naval Reserve Movement

THERE have been few movements of national importance that more vitally affect the interests of this country than the proposal to establish a sea-going naval reserve for the United States. The material for such a reserve is present in abundance. We have heard so much about the decline of our merchant marine, that we are apt to forget that this decline affects the deep-sea trade only, and that the scarcity of American sailors is confined to that branch of the shipping trade. Not many people realize that the tonnage of our coastwise and lake marine is greater than that of the whole merchant fleet of Germany, and that in all probability not far short of one hundred thousand men are required to man this tonnage. In the coastwise and lake trade then the Government can find a field for recruiting which contains material of the very best quality. We entirely agree with our contemporary, the *Marine Journal*, in its conviction that no better seamen can be found anywhere in the world in their several ratings than the masters, deck officers, engineers, oilers, water tenders, quartermasters, etc., of the large fleet of American steamers sailing from the port of New York and engaged in trade to our own eastern and southern ports, the Gulf of Mexico and the West Indies. From our coastwise shipping, then, it is possible to recruit for the naval reserve men who are skilled, reliable and possessed of that ardent patriotism which goes to the making of good navy sailormen. From the port of New York alone it should be possible to enroll several thousand men for the proposed naval reserve, who in the emergency of war might be assigned at once to the auxiliary ships which are necessary to a fighting fleet. Our navy could thus be strengthened at the very point where it has proved, and may yet prove, to be weakest in the stress of a long-drawn-out naval war. Similar recruiting could be done at Philadelphia, Baltimore, Norfolk, Boston, Portland, Puget Sound and San Francisco. This source of supply concerns only our coastwise trade. To this must be added the fruitful recruiting ground offered by the large body of qualified seamen to be found on the big steamers of the Great Lakes.

The proposal of the Government is to enroll the officers and men of the merchant service, give them the necessary amount of instruction and a reasonable compensation, and thus have at command a large force of trained men ready at the nation's call. We commend this movement to the hearty co-operation of every one who can assist in bringing it to a successful consummation. The naval reserve of Great Britain is large, efficient and full of enthusiasm. The service is extremely popular. Officers and men alike are proud of the distinction of wearing the naval badge, and of the fact that their ships fly the blue flag of the Royal Naval Reserve. There is no reason to doubt that a similar popularity would follow the establishment of a naval reserve for the United States Navy.

Morse Signals from London to New York

THE announcement recently made that Morse telegraph signals were being transmitted direct between London and New York over the lines of a cable company indicates that the chief problem of cable electricians for many years and the goal of endless experimentation and research has perhaps been attained. Furthermore, it is most appropriate that the engineer to whom this accomplishment is due, is one whose life has been spent in the development of submarine telegraphy, and that this successful outcome of a long series of experiments and practical tests forms a fitting climax to a notable career.

Those familiar with manuals of electrical testing will recall such methods as the electro-static capacity measurement of a submarine cable and the condenser method for determining its resistance associated with the name of John Gott, and it is to this distinguished British engineer that we now owe this most recent development which promises to revolutionize submarine telegraphy and make still more difficult its replacement by wireless. Mr. Gott, now well along in years, is the senior consulting engineer and chief electrician of an important cable company, over whose lines the new method has been used for several months with entire satisfaction to the engineering and operating staff of the company. Beyond the announcement of the success of the new invention and the securing of the rights for its use, no statement of technical or other details has been made, but we are authoritatively informed that the method has been used successfully over the long, or transatlantic, section of the cable for several months, and that the complete line between London and New York has been worked direct. Morse signals, sent by hand as fast as a skilled operator could put them on the wire, have been clearly transmitted, and while automatic transmission at high speed has not as yet been attempted, it is undoubtedly a possibility of the future.

Hitherto the limiting distance for the transmission of Morse or dot and dash signals through a submarine cable has remained at about 500 miles, and in practical long distance cable working use is made of a sensitive galvanometer, or rather some modification such as the siphon recorder, to indicate the flow of the current in the cable corresponding to the signals. Obviously to reproduce the range of the overland telegraph and the ease with which relays and repeating devices could be utilized to link up circuits of practically unlimited length was no mean task for an inventor, and many a cable electrician has carried on refined and indefatigable researches in this field. But submarine cable working at best is complicated by many considerations that do not apply to land lines, and the use of repeating devices is attended by difficulties realized by few outside of those electricians specially skilled in this department. Therefore Mr. Gott's discovery is little short of epoch making, and the details of the method and instruments, which we hope shortly to describe, will be awaited with great interest by all. Not only is the future of submarine telegraphy concerned, but also that of radio-telegraphic communication across the oceans. Will it be able to compete with more efficiently operated cables any more than it does with our present land lines?

The Passing of a Great Ironmaster

WITH the death of John Fritz, America has lost a pioneer ironmaster and one of the most distinguished manufacturers in that iron and steel industry in which this country leads the world. John Fritz died at his home in Bethlehem, Pa., on February 13th, at the age of 91, and he has left behind him a name and a record which in that broad field of engineering in which the activities of his busy and fruitful life was spent, are as honorably known abroad as they are in his native country.

In many ways John Fritz was the typical successful American inventor. Like many before him whose fame has gone abroad in the land, he started life in comparatively obscure surroundings and without any of the great advantages of education and financial competence which have given many of the later inventors and engineers a flying start in the race for successful achievement and honorable recognition.

John Fritz's father was German, his mother Scotch, and he was born in Chester County as far back as 1822. He picked up his practical education while working on a farm and later, as an apprentice in a blacksmith's shop, his apprenticeship dating from the year 1838. From the first he had a taste for mechanical work, and his biographers speak of his invention of an improved shotgun which was so efficient that the men of the neighborhood came to the young man eager to have his improvement applied to their guns. In 1844 Fritz went as apprentice to a mill for rolling bar iron which had been built at Coatesville, Pa., and there his ability so quickly asserted itself that in six months' time he was in charge of the plant as ironmaster. At once he began to introduce improvements into the puddling, heating and rolling of bar iron, with the result that in 1854 he was asked to assist in building the well known Cambria Iron Works at Johnstown, Pa.

Even at that early day the distrust by the workmen of labor-saving devices showed itself and the imported Welsh puddlers and rolling-mill men fought young Fritz at every turn. He lost his mill by fire and with it went practically all of his capital. Undaunted, he sought and obtained fresh financial backing, and came back and rebuilt his mill on a larger and more improved plan. Federal recognition of Fritz's genius came during the civil war, and the Government engaged him for the mill which it had established at Chattanooga, Tennessee. Here he manufactured rails and repaired locomotives for the Government.

When the Bessemer method for the production of cheap steel was introduced into this country, Fritz at once realized the enormous value of the process. Fritz, Holley, and Jones at once applied their genius to the improvement of the process, and it was they who laid the foundation of the enormous industries which are now represented by the iron and steel trade in this country.

It is well understood that the re-creation of our Navy was rendered possible only when our ironmasters agreed to take up the manufacture of armor plate and the necessary forging for guns of heavy caliber. In this movement, John Fritz stood foremost, and to him we owe the adoption of the Whitworth processes from England and the French processes of Schneider-Creusot; indeed his Bethlehem plant was the first to take up the manufacture of armor plates in the United States.

Lehigh University owes much to the trusteeship and generous assistance of Mr. Fritz, and Columbia University in 1898 conferred upon him the degree of Master of Arts. He was an honorary member of the American Society of Civil Engineers, was president of the American Society of Mechanical Engineers and also of the American Institute of Mining Engineers. In 1893 he was awarded the Bessemer gold medal by the unanimous vote of the Iron and Steel Institute of England. Furthermore, he was elected an honorary member of that society, at which time there were but five other names carrying that rare distinction. Among these were the Prince of Wales, King Edward of England, and the late Abram Hewitt of New York. On Mr. Fritz's eightieth birthday was founded the John Fritz Gold Medal for achievement in engineering sciences in this country. John Fritz was not more distinguished than he was beloved. The writer well remembers the occasion of the presentation of the Fritz medal to Sir William White, formerly chief constructor of the British navy, and the entrance of the venerable Fritz, rather late in the evening, when the whole audience of distinguished American engineers rose to its feet in loving and reverential tribute to the aged ironmaster.

Indexes in Scientific Books

IT is high time somebody voiced the sentiments of the world at large with regard to the almost universal custom among French scientific writers of publishing indexless books. Few things are more exasperating than a reference-book without an index—unless the contents of the book are self-indexing in virtue of an alphabetical arrangement or otherwise—and most treatises, in good standing, on scientific subjects serve more or less as reference books. German and English scientific books are almost always indexed, French almost never. The omission of the index is simply a piece of unmitigated laziness on the part of the author, who deserves to be castigated accordingly. It is unfortunately true that ideal indexes are rare in every language. Some one has expressed the importance of a good index by saying that an author should always make his own index, even if he lets somebody else write his book—and this is hardly an exaggeration. The present writer, who happens to take a particular interest in meteorology, has in mind several cases in the literature of that science in which the indexes are so badly made that it is usually easier to hunt down a topic in the text than to seek it by way of the index. Davis's "Elementary Meteorology," an otherwise admirable treatise, furnishes a shining example of the kind of indexing that ought to be avoided. After an entry in the index one finds references to a dozen different places in the text, including all the unimportant allusions to the topic in question, as well as the places where it is seriously discussed. It would have been so easy to put the important references in full face type or italics! On the other hand, the greatest of all works on climatology, Hann's "Handbuch," is very meagerly indexed. This work is rich in the local nomenclature of climate, but one seeks in vain to run down through the index the places in which the author mentions such interesting phenomena as the "pontias," the "Wisperwind," the "calina," and so on. The only large work in any language on atmospheric optics, Pernter and Exner's "Meteorologische Optik," contains no index, and few books stand in greater need of one. However, this case is a striking exception in the German literature of meteorology, whereas in the French literature of the subject one hails with delight the rare case in which a book contains a "table alphabétique" as well as a table des matières." Doubtless the botanist and the zoologist, the astronomer and the physicist, will eagerly join their meteorological *confrère* in an appeal to French scientific writers for more indexes.

If, besides indexing their books, the French should take to spelling English and German names correctly, then truly the millennium would be at hand.

Engineering

Sanitation at Panama.—Coming after the statement in the press that the mosquito has begun to develop again in great numbers in the Canal Zone, the last report of Col. Gorgas, chief sanitary officer of the Canal Zone, is timely. The tables show that the year 1912 was the most satisfactory of any since work started in 1904. For the month of December the average death rate per thousand among employees was only 7.14 as against 10.42 in 1911, 25.3 in 1908, and 45.73 in 1905.

Block Signals Compulsory.—In its final report to the Interstate Commerce Commission, the Block Signal and Train Control Board made the important recommendation that all interstate railroads should be compelled to adopt the block-signal system. The Board also recommended that tracks be inclosed and laws against trespassing be enforced. From eight to ten thousand people are killed in one way or another on our railroads every year, and a very large portion of these accidents are due to trespassing on the tracks.

Extensive Railroad Construction in the Northwest.—During the ten months which ended October 31st last, a total of 698 miles of railroad was constructed in Alberta, Canada. The *Engineer* draws attention to the fact that, since 1909, there has been an activity in railroad construction in Alberta without precedent in the history of the North American continent. In 1912, the Canadian Northern Railway built 463 miles of new line and the Grand Trunk Pacific increased its mileage from 384 to 619 miles.

The Three-million-yard Slide at Culebra.—Another huge slide, the largest that has yet taken place, has commenced at Culebra. The present indications are that about 3,000,000 cubic yards are in motion, and that it will take until the late autumn to remove the material. By that time the water will be in the cut, and the two big dredges, now building, will be on their way to the Isthmus. These dredges, which have a combined capacity of over one million cubic yards per month, should easily keep the cut open when once the water has been turned in.

Launching of the "Aquatania."—The launching of the "Aquatania" of the Cunard Line is set for Tuesday, April 22nd. This vessel is 900 feet long and she will exceed 50,000 tons gross in tonnage. In everything except speed, she will be an enlarged "Mauretania." Her probable speed will be 23 knots. She has been constructed with the same system of longitudinal bulkheads that characterizes the "Mauretania" and "Lusitania," and she has a watertight lower deck, extending throughout her whole length. Her stern frame and brackets weigh 130 tons with the other parts in proportion. The total number of persons she will be capable of carrying is about 4,500.

New Freight Terminal at Long Island City.—A new freight terminal costing $1,000,000 has been planned for Long Island City which will give manufacturing concerns in that locality close connections with the railroad systems of the country. The property on which the terminal and piers will be located covers several city blocks, and the plans include a huge freight yard with a capacity of about one thousand freight cars. The docks will accommodate the largest ocean-going freighters, and slips will be provided for the largest car floats that are used in this harbor. A belt-line railroad will connect the entire Queens district business section with the terminal.

Provision of Life-boats.—The British Board of Trade has just issued the revised rules for life-saving appliances at sea. A table showing the number of davits which must be provided specifies what number must be carried on vessels of various lengths. Thus, vessels under 160 feet in length must carry two davits. Vessels between 245 and 270 feet must carry six davits. Those of from 360 to 390 feet, ten davits, vessels of from 450 to 510 feet, fourteen davits. Those from 590 to 670 feet must carry eighteen davits, etc.; those from 750 to 840 feet, twenty-two davits, and vessels from 940 to 1,040 feet must carry twenty-six davits. The number of life-boats, or approved substitutes therefor, must provide a seat for every passenger. Motor life-boats may be fitted, but their use is not encouraged.

Electrifying the Panama Railroad.—Now that the relocation and reconstruction of the Panama Railroad is completed, surveys are being made for the transmission of power for the electrical operation of the road. Under normal conditions power will be taken from the Gatun hydro-electric plant, which is now under construction, but there will also be a connection with the present steam electric plant at Miraflores. Current will be transmitted at a pressure of 44,000 volts, and at the various points of distribution it will be reduced to the desired voltage for running the trains, for lighting the canal, and for operating the various machine shops and the gates and other appliances at the dams and locks. The railroad tracks will be spanned by the usual bridges for carrying the cables, etc., which will be placed at distances of from 200 to 300 feet, according to the local curvature conditions of the railroad.

Electricity

Novel Use for an Electric Flatiron.—A recent English electrical paper reports that an ordinary electric flatiron was called into playing a new rôle by the resourcefulness of an automobile driver. Being obliged to leave his car in an unheated garage over night, with the radiator and the cooling system of the car full of water during a spell of cold weather, the driver connected the electric flatiron to the lighting circuit and placed it under the car bonnet, where it served to protect the engine from probable destruction from freezing of the water.

Lowering of Resistance by Extremely Low Temperatures.—Recently reported experiments of a Dutch investigator have gone far to confirm the theory that the electrical resistance of all conductors would be reduced to zero by cooling the conductors to the absolute zero of temperature. By boiling liquid helium in a partial vacuum a temperature of only three degrees above the absolute zero was attained. At this temperature the resistance of mercury was found to be only one ten millionth as great as at zero Centigrade.

From Oil Lamps to Electric Lights at a Bound.—Thanks to a proposed harnessing of a small water-power in Yorkshire, England, the people in certain sections of that county seem destined to pass from the primitive candle and oil-lamp epoch direct to the electric light, in an evolution of illuminating methods skipping the use of gas altogether. Gas has never been provided in this section, but now a hydro-electric corporation composed of villagers, including the postmaster and schoolmaster, proposes to utilize the power of a small stream or "beck" to generate electrical energy and sell it at a charge of six-pence per unit.

Uninsulated Aluminium Windings on Electrical Machinery.—In the manufacture of electrical machinery the dissipation of the heat generated in steel coils and armature windings has been improved by using bare aluminium conductors without any other insulation than the film of oxide which forms on the surface of this metal. It has been known that coils wound with conductors of square cross-section cool down about 40 per cent better than coils wound with round wire, because with the round wires the air spaces between the consecutive turns and layers in the windings operate to check the flow of heat. The film-insulated aluminium conductors carry the benefits of using conductors of square cross-section a step further by getting rid of the cotton or asbestos insulation which is ordinarily used. The superior heat-dissipating qualities of these aluminium windings show to special advantage in the construction of lifting magnets which use heavy currents and are frequently called upon to lift hot castings, etc. In lifting magnets electric car motors, and many other devices the saving of weight is also an important item.

Sewage Purification by Electricity.—Electrolysis as an aid to sewage purification is a rather recent development and much more is to be expected from it. Oklahoma City has installed a plant where this treatment is successfully applied. A slow stream of city sewage is run through flumes between batteries of iron electrodes. A current of 270 amperes and 2.5 volts is passing between the electrodes and of course produces considerable electrolysis of the salts contained in sewage. The result of such electrolysis is to liberate a great deal of oxygen and some ozone at the anodes. This active oxygen and ozone oxidizes the organic matter into harmless and unobjectionable products. At the cathode some metallic hydroxides or bases are formed and these assist in coagulating the floating filth. Colloidal particles in fine suspension are also driven to the electrodes and collected in masses large enough to settle. This Oklahoma plant has a capacity of 750,000 gallons every twenty-four hours at a cost of operation of only $2.16. The municipality is now building a plant for the electrolytic formation of a flocculent precipitate, capable of treating 4,000,000 gallons daily.

The Talking and Moving-picture Machine.—On Monday of last week the Edison kinetophone was exhibited for the first time in public on the stages of four prominent vaudeville theaters in New York city. In the first film a man made a speech explaining the perfecting of the talking picture by Edison in the obtaining of absolute synchronism between the picture and the sounds. Then a pianist played, a bugler sounded the reveille, a young lady sang, and some dogs appeared and barked. The dogs gave the most striking and natural demonstration of the new apparatus. A second picture showed a minstrel show in which the various members of the troupe performed as naturally as in real life, though there was no mistaking the fact that the talk and music were produced by a phonograph. The intensification of the sound necessary in a theater apparently gives to it more of that metallic quality of which it has been successfully deprived in the smaller drawing-room machines. Nevertheless it is no more disagreeable than the voices of many of the actors who appear on the vaudeville stage. The present talking pictures last about five minutes each, though we understand a French machine has been perfected in which each film runs three times as long.

Science

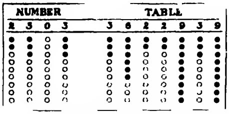
Restoring Elasticity to Caoutchouc.—Caoutchouc, which has a tendency to grow hard from exposure to the air, may have its elasticity restored, according to *La Revue*, by merely dipping it in a 3 per cent solution of aniline. To preserve the red or black tint which has a tendency to turn gray, a 1 per cent solution of penta-sulphate of potash is employed. This process, however, involves the disengagement of an offensive odor, but restores the elasticity admirably. Equally good results are said to be obtained with a mixture of glycerine and water, but this unluckily injures the look of newness.

International School Hygiene Congress.—The Fourth International Congress on School Hygiene will be held at Buffalo, N. Y., August 25th to 30th, 1913. The three previous congresses have been held in 1904 at Nuremberg, in 1907 at London and in 1910 at Paris. The object of the Congress is to advance the health of school children and while it will include in its display a scientific exhibit representative of the most notable achievements in school hygiene, it should also offer an opportunity for the exploitation of improved ideas and devices, whether patented or not, along the line of the Congress.

Chlorophyl and Ultra-violet Rays.—A report on the action of ultra-violet rays on chlorophyl has been made to the French Academy of Sciences. MM. C. Dhéré and W. de Rogowski, who have been investigating the subject, find that the pure chlorophyls present a marked relative transparence to the rays of the extreme ultra-violet portion of the spectrum. The natural chlorophyls, in solution in ether, show only a single band of absorption exclusively ultra-violet. This common band is situated in the middle region of the ultra-violet spectrum. This furnishes yet another proof of the biologic importance of ultra-violet rays as affecting vegetation.

Stereopticon Views in Natural Colors.—Following the giving of popular magic lantern shows in natural colors in Paris last summer which was made possible by the autochrome process of Lumière, Miss Elizabeth Marbury has introduced into this country similar lantern slides for the purpose of giving "Color Conferences" in which various famous places, paintings and the like are shown as they really appear. M. André de Fouquières lectures in his native tongue for such as understand his language, and other well-known American artists and lecturers describe the pictures for the benefit of American audiences. M. de Fouquières has lectured on Persia and Versailles, while Mr. Christian Brinton has described Spain, the Alhambra, and the wonderful paintings of Velasquez, Murillo, Titian, Rubens, Van Dyck and Goya in the Prado at Madrid. The process used in these pictures recently shown in New York is the Gervais-Courtellemont. It is similar in principle to the Lumière process heretofore described in our columns, the only difference being that in place of colored starch grains used as a screen on every plate microscopic colored bars are employed. On account of the density of the slides caused by this screen a very powerful 45-ampere arc light is required to project them and the heat is so intense that there is great danger of cracking if the slide is left in the lantern more than half a minute. The results obtained are very beautiful whether it be in reproducing paintings and tapestries or scenes from nature such as flowers, sunsets, and autumn foliage.

A New Hygiene for Gastric Troubles.—Recent cable dispatches from Paris have announced a novel method of treatment for stomach troubles, consisting in exercise taken by the patient while in the position known as "on all fours." Naturally this has aroused more or less derisive comment on the part of the non-scientific but ready-tongued journalists of the day, who have looked upon it as merely another instance in the long list of health fads and fake cures. That it is something more than this is proved by its serious presentation in such a journal as *La Gazette Medicale*, of Paris. The author of the treatment, Dr. Meunier, advises it, not as a panacea, but to remedy a specific condition, namely, the slow or imperfect evacuation of the gastric contents of the stomach, which is as is well known one of the most frequent functional troubles in the pathology of the stomach. Among the causes of this is what is known as the "stomachic ptosis," i. e., the stagnation of the mass of food contained in the pouch of the stomach. Dr. Meunier proved by a series of chemical experiments and X-ray photographs of several patients that evacuation of the stomach proceeded with much greater rapidity in this position than in the normal attitudes. The explanation of this is sought in the assumption that in the evolution of mankind a change has been made from the horizontal to the erect position of the body. The stomach has remained still imperfectly adapted to the new attitude and therefore functions better in that common to our four-footed ancestors before the intricate development of brain and hand led them to stand on two legs so that they might use their hands freely for offensive, defensive and industrial purposes, as well as gain the advantage of increased height and a greater range of vision.

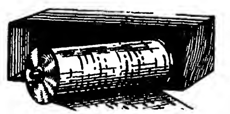


One of the original cards that Babbage used in his "calculating engine"—an invention which was never completed, but which was full of promise

Keeping Books by Machine

The Punched Card as a Saver of Brain Energy

By H S McCormack



By means of electrical contacts made through holes in thin sheets of brass, the most complicated selections can be artistically rendered upon the piano.

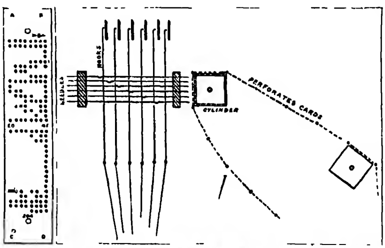
The facts embodied in this article warrant the predictions made by the author and are worthy of serious consideration Mr McCormack foresaw present needs by inventing years ago the original typewriter tabulator He has studied advocated and applied efficiency by originating and introducing mechanical inventions into accounting and billing and has proved that his insight into these intricate matters has been based not upon theories but fact The SCIENTIFIC AMERICAN *has arranged for several articles from this author, a recognized authority on efficiency as applied to office and executive management* EDITOR.

ABOUT a half century ago an English man named Babbage started work on an invention which is only now nearing completion He had studied the operation of the Jacquard loom which through the medium of punched cards weaves designs in fabrics Holes are punched in the cards to form any design required—no matter how ornate—and the card in turn causes the loom to produce the pattern in many varieties of textiles

Babbage figured that if punched cards could build designs in textiles there was no reason why they could not be utilized in the same way to make records.

With this idea in mind he built a device which he described as a 'calculating engine." He induced Parliament to appropriate £25,000 to further his invention Unfortunately this money was speedily used up in experimental work and Babbage got no further than a crude hand made and incomplete model of a device he had in mind Parliament was skeptical and refused to advance more funds, so Babbage was obliged to cease work and the invention was lost to England

Since Babbage's day the Jacquard principle has been successfully applied to musical instruments, and rolls of punched sheets operate pneumatically the keys of a piano or organ. More recently through the medium of thin sheets of brass in rolls an electrical contact is made through the holes, and the most difficult compositions are rendered upon the piano with the crescendo effects and tempo changes of an accomplished musician



The Jacquard loom through the medium of punched cards, weaves designs in fabrics. Holes are punched in the cards to form any design required, no matter how ornate, and the card in turn causes the loom to produce the pattern in many varieties of textiles.

How Our Population is Counted and Tabulated With Punched Cards.

Not many years ago the punched card principle was first applied to statistical work in the United States. Its most prominent use has been in its application to census work In fact it has always been called the census machine" Formerly the tabulation of population by States, cities towns and hamlets the segregation of the classes by native and foreign born male and female white and black, etc, was performed tediously by hundreds of clerks, with the usual percentage of errors and with little opportunity for securing automatic checks such as are to-day so vital in correct analysis. In addition it took about ten years to complete the work Now it takes ten months.

After the Government found this machine so successful in its work, it was adapted to cost accounting and has been used extensively by large firms Inventors of business appliances began to see that the punched card principle was capable of infinite adaptation and could perform operations which were previously considered impossible for a mechanical agency to execute

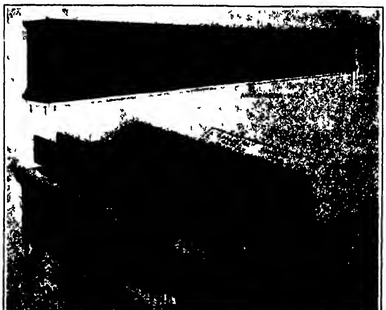
An interesting example is the automatic typewriter which actually takes the place of the human fingers for making duplicate letters

The Player-piano Principle Applied to the Typewriter

The writer a few years ago journeyed to Detroit, Mich, and inspected a hand made model of an automatic typewriter operator Here was employed the same principle—punched holes in rolls of paper—to turn out form letters actually typewritten At the time of the examination the hand made model was a very crude affair of the 'soap box' variety but the principle embodied in the model made it a commercial possibility One of the leading manufacturers has taken the device under his control, and developed it to a point of practical usefulness. It is almost impossible to recognize the finished product as an evolution of the crude hand made model produced by the inventors. The device to-day is supplied with a quantity of letterheads and the electrical current turned on through the application of the pneumatic principle the machine automatically picks up a letterhead and places it in the carriage of the typewriter The letter is spaced forward to the date line and the typewriter begins to operate as though actually under the impulse of human hands and fingers. The typewriter carriage moves to the right and the name, address and salutation are properly placed on the left of the letterhead.

Moving from space to space—the keys being depressed and the type bars flying up and down—there is something almost uncanny in the operation of the typewriter as it proceeds step by step to turn out a complete typewritten letter The completed letter is removed automatically, with no human hands near, and another letter is started. The name address and salutation are automatically changed and the operation repeated, letter after letter, until the machine automatically stops. Approximately four hundred duplicate business letters a day can be typewritten by this machine

The automatic typewriter takes the place of human fingers. It uses a punched roll of paper like a player-piano. By the application of the pneumatic principle the mechanism operates as though actually under the impulse of human hands and fingers.



Some day we will have a ledger cabinet, showing debit and credit dials, operated by cards. Clerks will be supplied with cards already punched with their own number, also the number of their department. When a sale is made they will punch and not write the amount as they do now.

Now comes what seems the most wonderful application of the punched card principle—that of mechanical bookkeeping and business recording—almost replacing the human brain in its performance, and indeed out distancing it in accuracy. Through a prearranged plan, four business men recently met: one a railroad official from a distant city, another an official connected with one of the country's leading industrial corporations, the third an official of the greatest textile company, while the fourth was the president of a concern of international reputation.

These men were brought together for the purpose of considering at a private demonstration a mechanical marvel which was the result of years of study, hardship and ingenuity on the part of an inventor assisted by mechanical experts whose experience qualified them to carry out the plans of the inventor. The result of years of painstaking effort, trials and disappointments, costly experiments and the expenditure of thousands of dollars could all be shown in a few moments. A few minutes demonstration does not, in this particular case, mean that these men, who were authorities in their fields, understood all they saw. What they beheld in actual operation was almost incredible. Although they were prepared in advance to see certain results accomplished, they could not grasp in less than an hour the details of a principle that will radically affect methods of mechanical accounting.

When these men met at the appointed hour and place, a waiting taxicab whirled them to a section of the west side of New York, which was totally unfamiliar to them. Arriving before a large loft building, the guide led the little party to a machine which accomplished what was heretofore possible only by human intelligence.

That machine performed the remarkable feat of recording approximately eleven entries of a single transaction—eleven entries which would ordinarily have to be made with a pen with eleven chances of making a mistake. In recording a sale the amount is entered upon a sales check, to be entered upon a bill, again upon the segregated sales record, again into the sales ledger, through another operation placed to the credit of the sales person, then to some department, in addition to a record as to whether the package was delivered by mail, carried away or sent by regular delivery or express. Instead of this constant juggling with the same figures through a maze of operations there will be an original entry upon a punched card and this card will, through the medium of motor driven machines, be automatically sorted into various divisions and subdivisions, and recorded item by item upon counters or wheel sets into adding mechanisms.

Prediction of the Mechanical Ledger

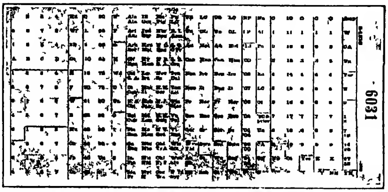
The ledger cards for the A and B ledger will be placed into a machine, the current will be turned on and with the sales checks in the magazine the machine will pick out the ledger card of Adam Aaron and from the magazine pick out the sales check of Mrs. Aaron and will debit the account with 13.73, and at the same time add the amount into the total register. After the ledger postings are complete, the sales checks will be passed through the machine again and listed according to departments. When the department totals are secured, the sales checks will be sorted and listed according to sales persons. At the completion of each sorting, the machine will automatically throw a lever and start the printing mechanism, which will deliver to the operator a printed adding machine list showing the items according to the desired segregations.

As the checks are received in payment or part payment of accounts, the entry will be punched upon a card, the ledger sheets will again be returned to the machine, and in red upon the ledger sheets will be printed the credits. Automatically the amount paid on account will be subtracted from the debit, and the balance, or amount remaining unpaid, will also be printed upon the ledger sheet.

The same principle will be applied to pay rolls, in other words, the laborious accounting of to-day, the repeated juggling of the same figures into the various combinations necessary to analyze a business scientifically, is to become a thing of the past.

If firms could eliminate half of the expense in their accounting departments, losses would be turned into profits and companies who have never paid a dividend, and those who have failed to pay ordinary dividends, would immediately be classed among the successful dividend-earning companies.

An understanding of the principles described will convey to the reader something of what these four men saw in operation. They saw entries of sales placed upon cards half the size of an ordinary playing-card. They saw when the entries were typed that under-



By means of such cards the United States Census Bureau tabulates the population by States, cities, towns and hamlets. The work, once performed in years by hundreds of clerks, with many errors, is now performed in ten months.

neath the figures were small round holes. The number of the department, customer's number, clerk's number, amount of sale, and other details according to requirements, were entered upon these small cards. A thousand cards were placed into the magazine of the machine and the current turned on. The machine itself was one hundred adding machines worked into an integral whole. A part of the mechanism was one hun-

A machine in use by the Census Bureau.

dred wheel sets, upon which were being accumulated these various amounts. If the machine picked up a card for Department 12, whatever amount had been punched upon this card was properly recorded upon wheel set 12.

When the machine finished sorting all the cards a lever was thrown, and automatically a printed strip appeared which was identical in appearance with the printed strip secured from a listing adding machine. The printed strip gave the results of departments 1, 2, 3, etc., up to 100, and opposite each department was set down the amount sold. Then, as a grand *finale*, the machinery clicked, a number of levers arose and there was printed one grand total showing all amounts which had been segregated to the various departments, all grouped into one grand total.

A Further Application of the Jacquard Principle

There is possible a still further application of the Jacquard principle and inventors will no doubt get to work to apply the same principle to addressing machines. An ordinary card index will be used. The name of John Jones, 261 Broadway, New York City, will be written upon a 3 by 5 card, while underneath the name and address will appear numerous perforations. The cards will be very inexpensive and can be utilized for follow up or for regular customers, pay roll, etc., and no expensive machinery will be needed to make up new stencils.

There is nothing but common sense in all this. To illustrate: Some four thousand years ago, a method of laying bricks came into practice, and this same method was handed down from generation to generation until very recently. Now, a disciple of Frederick Taylor—Gilbreth—has changed the general order of things and reduced the number of wasteful operations until to-day a bricklayer with less effort can lay double the number of bricks. Gilbreth did not discover any new principle. He simply applied common sense to a well known principle and applied it to mortar and bricks instead of tools and steel.

In almost every business house in the country some parallel case can be brought to light by an efficiency engineer when making his examination.

It is common to find a business firm applying efficiency to the order, requisition and billing while totally ignoring the same principles which could be applied to their voucher system with equal results in saving of time and expense. On the other hand, a department store with appliances and systems of various kinds will retain in its purchasing department an antiquated method for requisitions simply through failing to see that the same ideas used so effectively in other directions are really a principle which, when combined with a little common sense, go far toward reducing friction and promoting efficiency.

The Pneumatic Typewriter

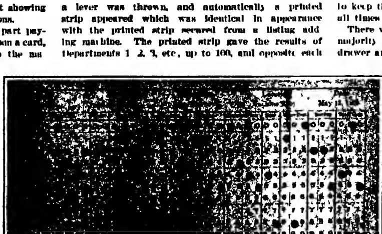
Now an inventor is working upon a principle where phonetic *sounds* can be recorded upon *strips of paper*. A man, for example, will call in his stenotypist, who will have this small device instead of the old fashioned note book and pencil. The little device will be a phonetic writer which will punch little holes in a strip of paper. These strips of paper will be fed into an automatic typewriter which will typewrite the words as the punchings in the strip will bring into play certain cards which will allow the machine to write the proper combinations.

Thirty years ago business houses had copyists who laboriously wrote pen-written letters, but to-day the stenographer fills the place. Twenty years from now bookkeepers, as they are known to-day, will be as great a curiosity as copyists are. In their place will be entry clerks of known ability and accountants who will take the machine-produced figures, and through the medium of graphic charts will present to the heads of departments a record of the previous day's business with comparative records by weeks, months and previous years. By ten o'clock each morning the record sheets dealing with vital totals will be placed upon the desks of the officials, who will then be in a position to keep their fingers upon the pulse of the business at all times.

There was a time only fifty years ago, when a large majority of small businesses were run on the cash drawer and hip-pocket principle. Conditions improved; the business men wanted a balance struck off at the end of the year. It was followed by the semi-annual inventory, after which the more progressive wanted a balance sheet every month.

Finally came the weekly report, while in some offices the daily report has arrived. But with increased competition, improved machinery and a reduction in overhead expense, and through the introduction of efficiency, the average business man, instead of delving into ancient history, a month old, will be able, after reading the latest quotations in the morning paper, to pick up his own balance sheet and know the latest quotation that his business has placed upon his ability.

With mechanical ledgers somewhat resembling telephone switchboards, bank clerks will punch cards as deposits are received or withdrawn.



The punched card principle applied to the keeping of a mechanic's account. This card has only to be run through a machine in order to obtain a printed statement of the man's output, time, and wage.

Tests of German Aeronautic Motors

OF the forty-five representative German aeronautical motors which were entered in the competition for the 50,000 mark prize offered by the Kaiser for the motor which should make the best showing in a series of tests conducted by the German government, which competition was held on the Kaiser's birthday, January 27th, 1913, but nineteen lasted through the series of tests. Of the nineteen the best showing was made by the Benz motor, a four-cylinder creation rated at 100 horse-power, designed by Chief Engineer Berger, and it emerged from the contest with a tally of [illegible] points against 170 which were chalked up for the performance against the nearest competitor. The other four prizes offered, [illegible] marks by the chancellor, [illegible] marks by the minister of war and 10,000 marks each by the secretary of the navy and the secretary of the interior were awarded to the makers of the 90 horse-power Daimler, 95 horse-power N. A. G., 72 horse-power Daimler and 70 horse-power Argus respectively. The scores of these four contestants were 170, 102, 400 and 150 points respectively.

The conditions imposed and the tests to which the motors were subjected were calculated to compare the motors with regard to their all-around efficiency for the service at hand, and to this end one of the conditions was that the entire motor must be assembled on the spot within a time limit of three days, one of the tests necessitated that the motor be sufficiently light to permit the plane in which it was mounted to coast or glide with the motor at a standstill for 15 minutes after the plane had been elevated for an equal interval, the elevating plane being fifteen per cent. In full the tests were: After erection within the three-day time limit the motors were subjected to a half-hour preliminary test running under full load on the block.

Mounted in an aeroplane the motor was run under full load for fifteen minutes and the plane guided so that it mounted a fifteen per cent grade; the motor then was stopped and the plane guided to earth, it being necessary for it to glide for fifteen minutes.

The motor was then run for seven hours without stopping.

The plane was then driven in horizontal flight for three hours, and after a stop of not half an hour another two and one half hour flight was indulged in.

The final test consisted in running the motor at top speed for half an hour.

The prize winning motor was possessed of four individually cast cylinders with overhead valves; bore and stroke were 130 and 180 millimeters, respectively, and the power developed was, as before stated, 100 horse-power at 1,250 revolutions a minute. When speeded up so that the crankshaft speed was 1,380 revolutions a minute the power was correspondingly greater. In the design of the motor no efforts have been spared to obtain reliability, as is evidenced by the duplication not only of the ignition system (two separate and distinct magnetos operating on separate plugs positioned on opposite sides of the cylinders were employed) but of the water circulating pump and the oil circulating pump as well.

By way of reducing the weight to the very last degree the cylinders are formed of a special iron alloy more easily worked than steel and at the same time more durable under the conditions. The cylinder jackets are of pressed steel and are sweated into place.

During the tests the gasoline consumption was but 210 grammes per horse-power hour, considerably less than that required for the operation of the average automobile motor. This showing is due in part to the arrangement of the intake manifold which is triple branched and innocent of sharp bends calculated to occasion banking of the mixture, and in part to the peculiar construction and location of the carbureter. The latter, or at least the larger portion of the latter, is cast integral with the crankcase so that it is in reality a part of the motor and not an appendage. The location has much in its favor since it not only economizes room and permits of a very compact construction but also eliminates projecting parts to a greater or lesser degree and provides a support for what would otherwise be a free end of the manifold, tending to eliminate vibration and strain on the manifold bolts. Moreover, as the air inlet leads from the inside of the crankcase the air supplied is heated so that a more homogeneous mixture is obtained. Air is admitted to the crank chamber through a valve provided with a protective screen.

Circulation of the cooling water is induced by a generously proportioned centrifugal pump driven from the cam shaft. A second pump of similar construction is provided for emergency use, and is driven by means of bevel gears from the magneto drive shaft. Careful balancing of all of the component parts, both statically and dynamically, has resulted in the production of a motor which is singularly free from vibration at all speeds. The weight of the motor including all piping and fittings is but 153 kilogrammes.

Wind-rolled Snowballs

"ONE of the strangest pranks of wind and snow was witnessed by residents of Davenport, Washington the afternoon of January 17th, when a strong gust of wind from the southeast blowing for a period of a minute and a half rolled thousands of snowballs from a particle of snow to big ones large as ordinary barrels and resembling in every respect huge rolls of cotton batting. A peculiarity of the unheard of prank of nature was the fact that nearly all the rolling was up hill, every south slope for miles being covered with the balls. An inch of snow of the right consistency

A group of snowballs rolled by the wind.

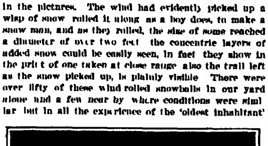
had fallen on a hard crust of snow and made possible this peculiar phenomenon. The photographs and this brief description were supplied by Edward H. Page of Davenport, Washington.

By an odd coincidence a similar freak has just been reported to the Editor by T. J. Moon of Middletown, N. Y. He writes:

"At the town of Potsdam, N. Y., on the 29th of last December occurred a light but very sticky fall of snow accompanied by a light wind which blew at right angles to the crest of a slight hill on the lee side of which were found the snowballs which are seen

View showing the concave ends of the balls.

in the pictures. The wind had evidently picked up a wisp of snow, rolled it along as a boy does, to make a snow man, and as they rolled, the size of some reached a diameter of over two feet; the concentric layers of added snow could be easily seen, in fact they show in the print of one taken at close range; also the trail left as the snow picked up, is plainly visible. There were over fifty of these wind-rolled snowballs in our yard alone and a few near by where conditions were similar, but in all the experience of the 'oldest inhabitant'



A nearer view of one of the balls.

no such peculiar occurrence had transpired before, and I have never heard of the like, so thought it might be of interest. A peculiar fact was that the rolls of snow were concave at the ends, like the vertebra of a fish, showing the size of the small bit of snow first picked up at the crest of the hill, and indicating that the increase had been in length as well as diameter."

A New Way of Studying Soils

"NO industry is so vital to the well-being of a nation as agriculture, and nothing is so vital to agriculture as the soil. From its treasury it has been estimated that we drew during the year 1909 more than $8,296,000,000, and its possibilities are as yet only partially realized. There are still in this country millions of acres which have never felt the plow, while those which are now under cultivation can, by the application of scientific principles, be made to produce many times the present value of their products. How to use and not abuse this great resource is the most important problem which faces the farmer of to-day—one worthy of the best efforts of our most profound and learned scientists, for upon its solution depends the future prosperity of the nation."

This statement from Bulletin 85 of the Bureau of Soils relating to the soils of the country. While a comparatively small percentage of the soils of the United States have been surveyed and analysed by the department, more than 800 types of soils have been discovered during the progress of the soil survey. The existence of such a large variety of soil types, each possessed of definite and peculiar characteristics, calls attention to the importance of a careful study of the soils and their relation to agriculture. The Bulletin says:

"The old idea of soil investigation was to collect samples, examine them in the laboratory, and see what differences could there be determined, the newer idea is to study the characteristics and properties of soils in the field, classify them according to obvious differences, and, with this information in hand, use the laboratory as a means of ascertaining the cause of such variations as cannot be determined in the field. This method of attacking soil problems is the reverse of the usual practice, but because of the great difficulty in duplicating field conditions, it is believed that a field examination should precede laboratory studies. The field observations can thus be used as a check upon laboratory investigation, and as an aid in their interpretation. Field studies furnish a safe and necessary anchor with which to keep the laboratory experimenter from being dashed against the rock of pure speculation. The classifying and mapping of the various soil types, together with the study of the conditions and processes under which they have been formed will furnish essential and invaluable data for the conduct of laboratory investigations. Nature's great laboratory is in the field, and a study of her methods cannot fail to offer many valuable suggestions, and, in some cases, is the only means of solving her problems. It is through a combination of field and laboratory investigations that an understanding of this extremely complex body—the soil—can be reached."

The Bulletin treats exhaustively of the soils, their origin, formation and best treatment for agricultural purposes, the great difference between the many types, and adds:

"Since the soil varies so much as regards both its inorganic and organic constituents, marked differences in character must necessarily result from the almost indefinite number of combinations which may be found. All these differences, however, may be traced to two sets of factors. First, the character of the rock or material from which the soil has been derived, and second, the processes or agencies by means of which this material has been changed from mere rock or rock debris into a medium suitable for the growth of plants. The former has to do with soil forming material, the latter with soil forming agencies. To these two groups of factors are to be attributed the numerous variations in soil conditions found over various parts of the earth.

"The importance of distinguishing between these two groups of factors cannot be too strongly emphasized. The tendency in the past has been to stress the former to the neglect of the latter and this has resulted in classifying together soils of very dissimilar character, simply because they were derived from the same rocks or from rocks which have been formed in the same manner."

The Current Supplement

IN this week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT Prof. W. E. Plummer speaks in the highest terms of the valuable contributions to knowledge which have been made by amateur astronomers.—Prof. Joly in a most interesting article, tells us how nuclei of radio-active material have in the course of long geological ages produced halos in the rock containing them, by the emission of disintegration products. These halos are of perfectly definite dimensions, and display many remarkable features. They have, moreover, a definite bearing on the moot question of the age of the earth.—James Pattison, in an illustrated article, tells us of the life buoys and light ships of New York harbor.—Dr. Ferranti, in delivering his James Watt lecture on the subject of Prime Movers, made some remarkable comments on the scope and limitations of the Diesel engine. This lecture is reproduced in the current issue.—Within easy access from New York city some remarkable features of the new water supply system are being worked out at the Kensico reservoir. These are described in an illustrated article.—E. N. da Andrade reports on the latest vacuum pumps, which far exceed earlier forms in the low pressures attainable.—Dr. H. E. Hollingworth writes on Experimental Psychology in its relation to medicine.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Prize for a Gasoline Substitute

To the Editor of the SCIENTIFIC AMERICAN

Permit me to direct attention to an error in proofreading which has crept into my story appearing in the current issue of SCIENTIFIC AMERICAN and entitled "A $100,000 Prize for a Gasoline Substitute" Please note that the British Society of Motor Manufacturers and Traders has offered a prize of $10,000 and not $100,000 for a gasoline substitute As stated in the fifth paragraph of the article, it is the International Association of Recognized Automobile Clubs that has offered the $100,000 prize, the grand total therefore being $110,000.

STANLEY PETMAN, M.E

Brooklyn, N Y

Patent Office Fees

To the Editor of the SCIENTIFIC AMERICAN

As a constant reader of your paper and one who is much interested in inventors and the welfare of the patent system, I beg this space to briefly express my views on the question of increasing the fees for patent applications with especial reference to the article in your paper of February 8th, 1913 In this article you refer to the tremendous sum which has been earned by the Patent Office out of fees and turned into the Treasury This is interesting, but so far as its effect on Congress is concerned in seeking additional appropriations, it is "a last year's bird nest" as Congress is looking to results at the present time Now, as a matter of fact, I agree with the proposition that the Patent Office should not be judged by the profit it makes and am convinced that the benefits of the patents to the country at large are so great that inventors should be encouraged to the extent of large contributions from the Federal Government. But can we get the legislators to this view? I fear not. We must not only point to past profits, but we must definitely estimate future ones Now as to your suggestion that the fees should be reduced, you doubtless are aware that the Economy Commission recommended an increase to $50 while the bill introduced by Mr Bulkley and now on the calendar of the House of Representatives provides for an increase of the filing fee to $20, making a total of Government fees of $40 Suppose, however, the Government filing fee of $15 should be reduced even $1, what would the result be based on the report of the Commissioner of Patents for the year ended June 30th, 1912 The net surplus for that year is given as $68,147 20 The number of applications for patents filed that year was 79,747, so that if the filing fee had been $1 less, there would have been a net loss of nearly $12,000 instead of a surplus. Let our hopes be for better and prompter service by the Patent Office instead of for lower fees

CONSTANT READER.

A Correction

To the Editor of the SCIENTIFIC AMERICAN

In the composite price list of American cars, published in the January 11th issue of SCIENTIFIC AMERICAN, you published some erroneous figures with reference to the prices on Packard cars

Your Packard figures include a "25" roadster at $950, an "18" touring car at $2,800, and a "30" touring car at $3,700 We manufacture only maximum service cars, and you are doubtless aware that it would be impossible for anyone to market such vehicles at the prices named and remain long in business. Our line of motor carriages consists of a "38" at prices ranging from $4,150 to $5,400 and a "48" at prices from $4,650 to $6,100

The inquiries which we have received since the appearance of your price list speak well for your circulation but are causing us serious embarrassment. We feel confident that your own sense of fairness will induce you to correct the erroneous impression which has been created among your readers

PACKARD MOTOR CAR COMPANY,
F G EASTMAN, Advertising Department.

Detroit, Mich

Aeroplane Design

To the Editor of the SCIENTIFIC AMERICAN:

One of the most important and at the same time one of the most intricate problems of the aeroplane is the proper shape for the supporting surfaces The cut-and-try method of testing in vogue at the present time has been the means of supplying a deal of valuable data, but, as will be readily understood, with the most delicate instruments for measuring the air pressure, and with the utmost care in the reading of these, the method can give only approximate results, and is therefore inadequate to the present need of a designer.

In place of this arbitrary and wholly artificial means of testing, the writer would direct the consideration of those interested in the practical development of the aeroplane to another, which in addition to the advantage of giving exact results, is simple and direct.

If a rectangular piece of silk be suspended in a gentle current of air, it takes a curved form as the result of the two forces which act upon it These forces are (1) its weight acting vertically downward with a pressure equal in intensity at all points on the surface, (2) the pressure of the air This latter force is horizontal in direction at the extreme front edge of the silk, but, just as the air flows beneath the fabric it is deflected slightly downward as a result of its reaction with the surface This downward movement of the air particles is communicated to the air below not immediately adjacent to the silk The upward component of the pressure of the air consequently diminishes, with the result that more and more surface is exposed to maintain the equilibrium

In the above experiment, for the sake of clearness, we have dealt only with the air below the silk The same method of reasoning is equally applicable to the upper side. The air streams are flowing horizontally at the front edge, immediately behind it they are pulled downward by the displacement caused by the cross section of the arc This pull downward is a pull upward for the plane The air would now flow parallel with the surface, and would exert no further lift whatever were there no further curve in the surface, but the flexible silk automatically adjusts itself by means of its weight, falling and increasing the cross section until the balance is restored

We would emphasize then the fact that the curve taken by a flexible surface of uniform weight suspended freely by one edge in a current of air is a graphical representation of the two forces which act upon it, and that at all points on the surface the two forces are in equilibrium Also, that for the particular conditions under which the experiment is conducted, the balance is maintained with a minimum of drift, for there is of course a decrease in the absolute drift component of the air pressure, *proportional to the decrease in the absolute lift.*

The application then of the method of the experiment, as a system of aeroplane supporting-surface graphing, is obvious, for weight balanced by air pressure is a condition identical with the principle underlying the operation of the aeroplane.

A rectangular piece of stout fabric of the actual width to be employed in the construction of the machine itself could be suspended by one edge in a wind tunnel, and the load, that *is weight per square foot of supporting surface*, distributed uniformly over the whole area by passing flat metal bars through loops in the upper side of the fabric By placing these parallel with the front edge, and by spacing them short distances apart, the surface would be entirely flexible, free to take up the position in which its own weight would balance the reaction of the air upon its surfaces. This position could be fixed photographically and the pattern thus obtained used for the construction of a rigid plane

Such a method undoubtedly would be of incalculable use to a constructor, for not less important than the facility of the system is the interchangeability of the elements involved. As to the question of the angle of incidence, it will be readily seen that this could be adjusted as desired in either or both of two ways by altering the load or by changing the relative speed of the air Thus, a designer would be enabled to produce the most efficient wing form for any possible combination of flight conditions.

It is interesting in this connection to notice the high degree to which the above principle has been carried in the structure of that bird of the water, the sailing vessel, whose wing, automatically varying to the most favorable form under any conditions of wind pressure, and direction of wind pressure, can propel the craft almost into the teeth of a wind In fact, no better proof of the practical worth of the idea suggested could be wished for than this, that no rigid surface, plane or curved has been found to give the all-round efficiency of the flexible sail

It seems probable even that with proper observance of the perfection of detail required in the design of aerial vehicles, substantially the same method of leaving the fabric flexible might be applied with interesting results to the construction of an aeroplane's wings However, it seems probable that, as in both classes of vehicles the best efficiency could only be obtained by altering the length of the chord, the best way would be, as is the present practice, to construct the machine rigid and designed for the highest speed the craft is meant to attain, since it is of course at the maximum speed that exquisiteness of design is most required Moreover the rigid structure would seem to be particularly adapted to the aeroplane, since full speed when once attained is as regular as that of the highest types of automatic machinery

For the verification of the conclusions reached in the preceding, the writer would point out that the curvature taken by the surface in the experiment is a modification of one of the conic sections known as the semi-parabola, and would refer to the fact that this curve is universally acknowledged by mathematicians and has been experimentally proved to be the basic curve for wing sections. Indeed, it would be a comparatively simple matter to plot the curve for any combination of weight and horizontal pressure, were it not for the fact that the action and reaction of the particles in a fluid are exceedingly complex and consequently considerably modify the result. It is in overcoming this difficulty that the method outlined above should prove so effective

Bowmanville, Ont. GRANT LINTON.

Are Levees a Failure?

To the Editor of the SCIENTIFIC AMERICAN

All rivers subject to floods if they flow through flat lands, form a sort of natural levee This process is going on at my office door on the east bank of the Greenbrier River, on a small scale When the river is in flood the plain on this side is covered with water Where the rapid current of the river comes in contact with the more quiet water on the plain or bottom land and is checked by it, a line of sediment is deposited thus forming a natural levee Left to nature, the river bed the bottom land, and the natural levee rise together keeping a sort of relation to one another If you build an artificial levee you interfere with this relation, and as the bed of the river rises by sediment, you must keep on adding to the height of the levee until in time the bed of the river will be above the country around, because the flat country not getting its proportion of deposit does not rise as it did before the levees were constructed by man Now to some extent the artificial levees make more current and keep the deposit from forming so rapidly in places but it makes the condition worse in others, when current is sluggish From this theory the remedy would be to control the flood waters about the heads of the streams by dams No large river has ever been successfully leveed, nor ever will be, for the reason given The attention of people living along rivers subject to devastating floods should be called to this scientific fact

Marlington, W Va. J W PRICE, M D

The Spring Wheel

To the Editor of the SCIENTIFIC AMERICAN

Referring to letter from Mr O F Fischer in your issue of February 1st under the title of The Fallacy of the Spring Wheel It would hardly be fair to the automobile world to allow a conclusion so erroneous to go unanswered

The basis from which your correspondent reasons implies that there is but one kind of spring wheel and that that kind is of the crudest and most imperfect form of wheel The only arrangement that he indicates is one in which the springs at the top of the wheel and those at the bottom of the wheel carry the load and he practically assumes that there is no other method of creating a spring wheel Having started out from an erroneous basis he must necessarily reach an erroneous conclusion

Everyone in the least degree familiar with the spring wheel art knows that any radial arrangement of springs by which the springs at the top and bottom of the wheel carry the load chiefly, or any arrangement in which the load is passed from one spring to another or from one series of springs to another is a long ways behind the present condition of the art

Further, anyone who has studied the question and kept *au courant* with the art is familiar with the fact that the highest type of spring wheel requires all of the springs to assist equally at all times in carrying the load and in meeting the shocks and further that in the highest type of spring wheel when the wheel is operated over a perfectly level road the springs are not flexed in the least degree, but remain stationary just the same as the eliptical spring

Your correspondent falls into another very great error in assuming that a spring wheel is required to effect the same amount of resilience as the elliptical springs of the car It is a well-known fact that the resilience offered by a pneumatic tire is but a small percentage of that of the ellipitical springs and thus if the spring wheel reproduces the same shock-absorbing qualities as the pneumatic tires it answers the purpose perfectly though it affords but a small percentage of the resilience that the elliptical spring affords

The writer is thoroughly familiar with the spring-wheel art and he is fully aware that there is no subject in which the automobile trade generally is so misinformed and so needlessly skeptical as to the spring-wheel art, and he therefore wishes to state that every owner of an automobile and everyone interested may take heart, notwithstanding the oft-expressed impossibility of a spring wheel as the spring wheel will supplant the solid wheel with the solid tire and solid wheel with the pneumatic tire beyond the least shadow of a doubt and no one can know the facts of which the writer is possessed without realizing the correctness of this statement

For the information of those who are in doubt the writer will further state that there is already on the market in a small way a spring wheel which meets the requirements above outlined and which is rapidly gaining headway, and it is only necessary for anyone interested to keep his eyes open as they will be seen in large quantities right in New York city within a very short time

New York city M K DOMIS.

Olive Bridge dam Esopus Creek flowing through temporary tunnel.

Building Olive Bridge dam to form the Ashokan reservoir

Creating a Subterranean River Ninety Miles in Length

How Catskill Water is Being Brought to New York

Phenomenal Growth of New York.

GREATER NEW YORK is adding to its population at the rate of 140,000 people per year—an increase which is absolutely without precedent or parallel in the growth of the world's great cities. Such an increase as this renders enormously difficult the problems of housing, food supply, transportation and proper hygiene. For many years past and long before the rate of increase had reached its present proportions, the city authorities have been at their wits' end in endeavoring to enlarge the various facilities of the city so as to keep pace with the demands of its ever-growing population.

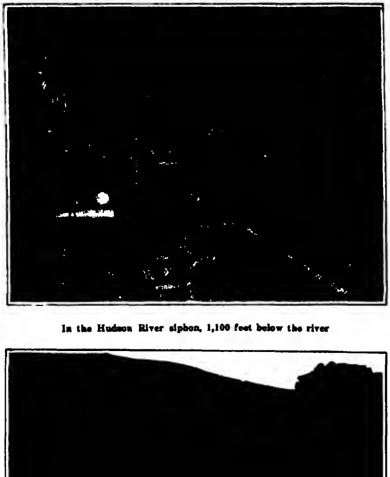
The Peril of Water Famine.

With the exception of rapid transit there is no problem of the city's need which has proved more serious, more pressing or more difficult, at least in recent years, than that of providing an adequate supply of pure drinking water. At frequent intervals the city has been threatened by that justly dreaded terror, a water famine—justly dreaded because a shortage, to say nothing of a total failure of water, might mean an outbreak of pestilence, to say nothing of the loss and inconvenience occasioned by the shutting down of the various factories and smaller industries which a shortage of the water supply would necessitate.

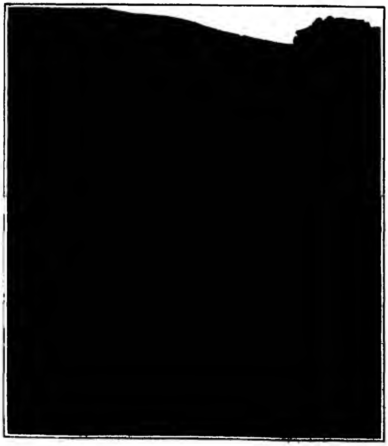
It is not so very many months since the whole city was watching with a very anxious eye, the steady fall of the water levels in the various reservoirs of the Croton watersheds, for a season of drought extending far into the winter had served to bring the hitherto remote peril close to its very doors.

In view of the rapid growth of the city it was evident at the outset that any adequate scheme for increasing the water supply must be made upon the broadest possible scale, and that it should make provision not only for the immediate needs of the city, but for those of many a decade to come. This has been done by the Board of Water Supply, and it is the purpose of this and the following article to show that the project of bringing the Catskill Mountain water to New York has been considered on such adequately comprehensive lines that the possibility of any shortage of water in this great city has been removed into the very far future.

On May 14th, 1905, the State Water Supply Commission approved of the application of the Board of Water Supply of this city for obtaining a daily supply of 500,000,000 gallons of water from the Esopus, Rondout, Schoharie and Catskill creeks in the Catskill Mountains, at an estimated cost of $161,857,000. In 1910 a plan for the distribution of the water throughout Manhattan, Queens and the Bronx by a deep pressure tunnel was approved by the Board of Estimate and Apportionment. The additional cost of this scheme is $15,000,000.



In the Hudson River siphon, 1,100 feet below the river



Placing the nine and one half foot steel pipe—Foundry Brook siphon.

The New Scheme of Water Supply

The new supply of water, of the finest mountain quality, is to be taken from four watersheds, having a total area of nearly nine hundred square miles. The total estimated capacity of these four gathering grounds is, even in a series of unusually dry years, equal to supplying 770,000,000 gallons daily. Reservoirs will be built as they are required, in each of these basins, and they will be connected by aqueducts. For the present, the Esopus watershed only is being developed. In a series of dry years this watershed can furnish a daily supply of only 250,000,000 gallons, but the aqueduct leading to the city is being built of double that capacity, or 500,000,000 gallons daily. The first contract for construction was let at the close of 1906. In 1907 to 1908 about five per cent of the work was completed from Ashokan reservoir in the Esopus watershed to Croton Lake. By the end of 1909 22 per cent was done, 60 per cent at the close of 1910, 78 per cent by 1911, and at the present time about 95 per cent of the work is done. The delivery of water into the Croton reservoir, which will be possible this year, will prevent any possibility of water famine during the completion of the new aqueduct to New York.

The system under construction and now nearing completion consists of a large reservoir in the Esopus basin, an underground aqueduct seventeen feet in diameter by which the water is led for sixty-four miles to another large basin, the Kensico reservoir, which will serve for emergency storage, a third reservoir situated about fifteen miles south of Kensico and just over the New York city line, known as the Hill View reservoir, which will equalize the difference between the use of water in the city, which, of course, varies from hour to hour and from day to day, and the steady flow coming in from the aqueduct. Between Hill View and the city the system consists of a deep circular, high-pressure tunnel, through which the water will be led beneath Manhattan, to be distributed by surface mains throughout that city, and also throughout the other districts of Greater New York.

The Ashokan Reservoir.

The great Ashokan reservoir is situated about fourteen miles west of Kingston on the Hudson River. Its cost is $18,000,000, and it will hold sufficient water to cover the whole of Manhattan Island to a depth of twenty-eight feet. The water is impounded by the Olive Bridge dam, which is built across Esopus Creek, and also by the Beaver Kill and the Hurley dikes, which have been built across streams and gaps lying between the hills which surround the reser-

The Olive Bridge dam, 4,650 feet long, 220 feet high.

Diamond drill boring horizontal hole 1,100 feet below Hudson River

voir. By the first of January, this year 73 per cent of this work was done. The dam is a masonry structure 190 feet in thickness at the base and 23 feet thick at the top. The surface of the water when the reservoir is full is 590 feet above tide level. The total length of the main dam is 4,650 feet, and the maximum depth of the water is 190 feet. The area of the water surface is 12.8 square miles, and in preparing the bottom it was necessary to remove seven villages, with a total population of 2,000. Forty miles of highway and ten bridges had to be built. In the construction of the dam and dikes it was necessary to excavate nearly 3,000,000 cubic yards of material and 8,000,000 cubic yards of embankment and nearly 1,000,000 cubic yards of masonry had to be put in place. The maximum number of men employed on the job was 3,000.

The Ninety-two Mile Aqueduct

The water is conducted from Ashokan reservoir as a huge, underground, artificial river. The aqueduct is ninety-two miles in length from Ashokan to the northern city line, and it should be explained that it is built on a gentle grade, and that the water flows through this at a slow and fairly constant speed. The aqueduct contains four distinct types: the cut-and-cover, the grade tunnel, the pressure tunnel, and the steel pipe siphon. The cut and cover type, which is used on fifty five miles of the aqueduct, is of a horseshoe shape and measures seventeen feet high by seventeen feet six inches wide, inside measurements. It is built of concrete and on completion it is covered in with an earth embankment. This type is used wherever the nature of the ground and the elevation allow. Where the aqueduct intersects hills or mountains, it is driven through them in tunnel at the standard grade. There are twenty four of these tunnels, aggregating fourteen miles in length. They are horseshoe in shape, seventeen feet high by thirteen feet four inches wide and they are lined with concrete. When the line of the acqueduct encountered deep and broad valleys, they were crossed by two methods. If suitable rock were present, circular tunnels were driven deep within this rock and lined with concrete. There are seven of these pressure tunnels of a total length of seventeen miles. Their internal diameter is fourteen feet, and at each end of each tunnel a vertical shaft connects the tunnel with the grade tunnel above. If the bottom of the valley did not offer suitable rock for a rock tunnel, or if there were other prohibitive reasons, steel siphons were used. These are nine feet and eleven feet in diameter. They are lined with two inches of cement mortar and are imbedded in concrete and covered with an earth embankment. There are fourteen of these pipe siphons in a total length of six miles. At present one pipe suffices to carry the water. Ultimately three will be required for each siphon.

Of the many siphons constructed, by far the most interesting and difficult is that which has been completed beneath the Hudson River. The preliminary borings made from scows in the river showed that great depths would have to be reached before rock sufficiently solid and free from seams was encountered to withstand the enormous hydraulic pressure of the water in the tunnel. After failing to reach rock by the scow drills two series of inclined borings were made from each shore, one pair intercepting at about nine hundred feet depth and the other at about fifteen hundred feet. Both showed satisfactory rock, and accordingly a shaft was sunk on each shore to a depth of approximately eleven hundred feet, and then a horizontal tunnel was driven connecting the two. It is of interest to note that because of the enormous head, which must be measured from the flow line far above the river surface, the pressure in the horizontal tunnel reaches over forty tons per square foot.

This will form part of a system of new highways

Driveway along crest of Olive Bridge dam

Through this chamber the flow of water to the aqueduct will be regulated

Ashokan reservoir—Upper gate chamber

Constructing a steel and concrete section of aqueduct

This section consists of a steel pipe, lined internally with two inches of cement mortar, and embedded in reinforced concrete.

Kensico Reservoir

Next to Ashokan the most important basin is the Kensico reservoir, which lies east of the Hudson and is situated thirty miles north of the City Hall. It will hold sufficient of the Catskill water to supply the city for several months. Its purpose is to act as an emergency storage reservoir, so that if it is necessary on account of accident to interrupt the flow in the seventy seven miles of aqueduct between Kensico and Ashokan, this can be done without interrupting the city supply. The cost of this work is $8,500,000.

The reservoir will be formed by a huge masonry dam across the valley of the Bronx River. The surface of the water will be at an elevation of three hundred and fifty five feet above mean sea level and will cover 2,218 acres. It will contain when full about 40,000,000,000 gallons, of which 30,000,000,000 gallons, or sixty days continuous supply at 500,000,000 gallons daily, will be available. The main dam will be eighteen hundred and forty three feet long. The total height will be three hundred feet. It will be two hundred and thirty feet thick at the base and twenty eight feet thick at the top. The average depth of the reservoir will be one hundred feet, and its maximum depth at the wall of the dam will be one hundred and fifty five feet. An interesting feature of the construction is that the entire dam will be divided into sections by transverse expansion joints, which will be placed about eighty feet apart longitudinally. On one side they will be faced with concrete blocks forming a series of vertical tongues and grooves against which the masonry of the other side will be built. Near the up-stream face will be a copper strip which will cover the expansion joints and act as a water stop, the strips continuing from the bottom to the top of the dam. In order to catch any water that may seep through from the up-stream side, diagonal wells will be built fifteen feet apart, measured longitudinally. They will be formed of porous concrete blocks. They will reach from the top of the dam to a longitudinal inspection gallery at about the level of the reservoir bottom, which will in its turn be connected with a transverse drainage gallery,

which will lead to the downstream base of the dam. This will prevent any seepage entirely through the wall and will avoid that discoloration which is liable to mar the architectural beauty of structures of this kind.

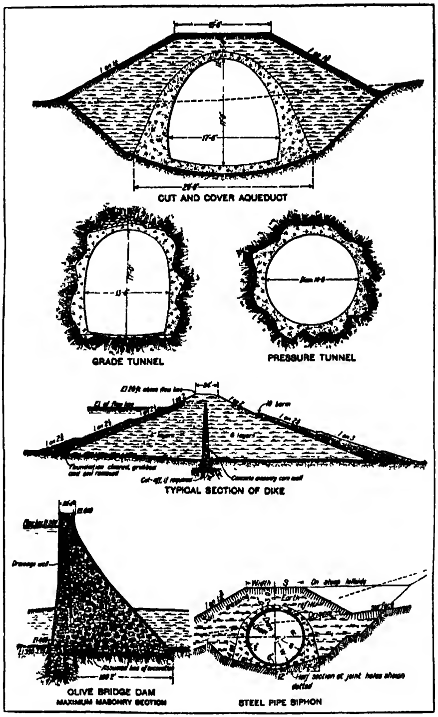
Aeration and Filtration.

Both at the Ashokan and Kensico reservoirs aerators will be built, each of which will be capable of passing and treating all the water which will flow in the aqueduct. The aerator is a large rectangular basin five hundred feet by two hundred and fifty feet, containing about eighteen hundred nozzles, through which jets of water will be thrown into the air. The nozzles will be of such form that the water will be divided into a fine spray and this will permit of a thorough admixture of the oxygen of the air and the removal of gases and matters which would cause taste and odors. For the present no provision will be made for filtrating the Catskill water but provision has been made for a filtration plant by the purchase of three hundred and fifteen acres of land near Tarrytown, adjacent to the aqueduct.

Hill View Reservoir

From Kensico the water will flow to the Hill View reservoir which will serve to equalize the difference between the amount of water used in the city and the amount of water flowing in the aqueduct. Also it will furnish a great quantity of water should there be an immediate demand such as occurs during a great conflagration. Its capacity will be 900,000,000 gallons. The reservoir is divided into two basins so that one may be used while the other is being inspected for repairs. The aqueduct is carried within the wall which divides the two basins, and the aqueduct water can be passed through the reservoir and delivered directly into the city tunnel.

Our thanks are due to Mr. Alfred D. Flinn, Department Engineer of the Board of Water Supply, for courtesies extended during the preparation of this article.



Sections of the aqueduct and dams—Catskill water supply

The International Building Exposition in Leipzig

An International Building Exposition will be held in Leipzig this year. The time during which applications for space may be submitted has recently been extended until the end of February in order to permit firms which have not yet submitted applications to make good this omission. Space to the value of more than a quarter of a million dollars has already been allotted and the demand is still brisk.

Dr. Probst of Berlin, whom the directors sent to this country to arouse American interest in the exposition and to secure adequate participation therein by the United States Government, cities, associations, industrial firms, etc., has described his travels in a lecture, delivered in Leipzig, of which the following is an abstract.

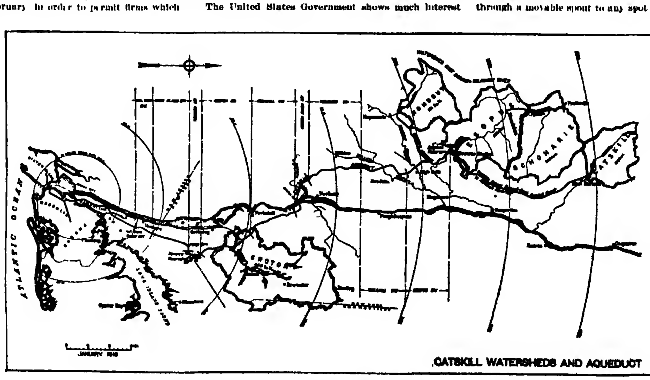
The United States Government shows much interest in the exposition. The cities of New York, Chicago, Philadelphia, and San Francisco, the American Bridge Company (the oldest and greatest of American bridge-building firms), and the Canadian Railway Company will exhibit typical models and photographs of "skyscrapers," bridges, city views, schools, waterworks, etc. Very complex problems are presented to American engineers by peculiar geological, climatic and traffic conditions. The exhibition will show how these problems are solved in the eastern, central, and western States.

Both the rapidity and the methods and materials of American building are greatly influenced by the exceedingly high rate of wages ($5 or $6 per day) and by the almost total absence of legal building restrictions. The high cost of labor has led to the substitution of machine work for hand work as far as possible. The lack or deficiency of building laws in many places has permitted speculative builders to erect unsafe structures. A striking instance of this was revealed after the earthquake in San Francisco, where foundations of many of the fallen buildings were found to have been constructed in the most reckless manner. Praiseworthy energy was then displayed in the erection of a new city which may be regarded as structurally unexceptionable. Examples of the new buildings of this beautiful city will be represented at the Leipzig exposition.

Almost everywhere in America Dr. Probst noted with approval a sharp demarcation between business sections and residence sections, which does not exist in Europe outside of England, but he was unfavorably impressed by the lawless co-mingling of ordinary four-story and five-story buildings with towering structures of thirty or more stories. American engineering societies, however, are beginning to give attention to aesthetic and hygienic considerations which have hitherto been ignored, and many of their members will visit the Leipzig exposition where these matters will be fully illustrated.

Dr. Probst finds ferro-concrete the building material most extensively used in America, and mentions an ingenious device employed in the construction of most large buildings and consisting of a central tower from which the concrete flows through a movable spout to any spot where it is wanted.

The projected Chicago ship canal will be well represented at Leipzig. Dr. Probst regards Canada with its great fertility and scenic beauty as the land of the future and the most promising field of activity for the building engineer. In conclusion, Dr. Probst named, as the two most eminent American building engineers, Lindenthal and Hornbostel, both of whom will exhibit models of their works at the coming Leipzig Building Exposition.



Map showing Catskill and Croton watersheds and the aqueduct.

Magazine door, which closes automatically in case of explosion.

Dynamite chamber Note the roof over the shelves.

Drill posts set up at a tunnel heading, two drills on each post.

Supplying a Metropolis With Mountain Water

How Mining Operations Are Being Carried on Through the Heart of New York

THE preceding pages tell how the new aqueduct is being constructed from the Catskill Mountains down to the New York city line, where, at the Hill View reservoir the waters will pause before taking their plunge into the heart of the city

The problem of admitting so large a flood into the metropolis is no small one, particularly when the chief demand for the water will come from those sections of Greater New York which lie many miles away For the present at least little if any of the Catskill water will be used in Manhattan and the Bronx but most of it will be consumed by the boroughs of Brooklyn, Queens, and Richmond The Water Waste Campaign which has been carried on for the past few years has so far reduced the consumption of water that the Croton system, which can furnish steadily 350,000,000 gallons of water per day, can easily take care of the immediate wants of Manhattan and the Bronx as well as the demand from these two boroughs for many years to come It is not likely that the population in Manhattan will increase much unless it undergoes a marked vertical growth for now there are practically no more vacant lots to be built upon So that in estimating the future demands upon the Croton system we must consider chiefly the growth of population in the Bronx In the other three boroughs of the city however there is a present demand for water and the probability of large increases in population in coming years.

To conduct the Catskill water into Brooklyn and Queens, it was decided to build a trunk line, so far beneath the surface that there would always be 150 feet of good solid rock for the roof of the tunnel, and provide a course for a subterranean river which could be tapped as needed for the city's supply, and which, at the same time, would be so completely buried that it would never menace the safety of structures above it. When this tunnel is completed it will be one of the most durable pieces of work ever constructed by man for practically nothing but an earthquake can destroy it and even this possibility is very remote, for the rock underlying New York is of very early formation and not at all liable to seismic disturbance And so the city tunnel of the Catskill aqueduct is being bored through the rock on the average of 200 to 250 feet below the surface except in places where the nature of the rock is of such a character as to call for a much greater depth

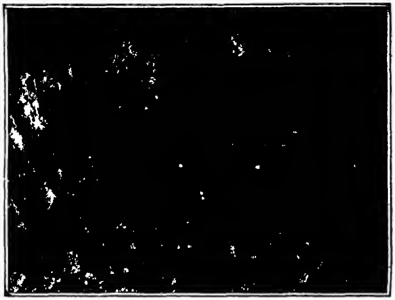
The first dip takes place just above the Harlem River, where the tunnel drops down 382 feet below the ground level. Then it runs practically horizontally until it passes the dip in the rock under 125th Street Thence it rises again and maintains a practically constant level of 200 feet under the city, until it arrives at the ancient bed of the East River A glance at the map of New York city will show that the East River makes a decided turn about the lower east side or "heel" of Manhattan. In pre-glacial times, the East River had no elbow in its course, but ran directly across the heel of Manhattan, and it wore away the rock in its bed to considerable depths. However, the large deposits of earth and rock carried by the glaciers caused the river to be pushed eastward out of its normal channel and over the solid rock beyond When

The height of the Woolworth Building equals the depth of the deepest aqueduct shaft in New York.

borings were made for the aqueduct through this section of the city it was found necessary to lay it at a depth of about 750 feet below the surface As indicated in the accompanying drawing, much of the rock through this section is decayed and unfit to form the walls of a high pressure aqueduct which is being built to last for all time The present channel of the East River on the other hand passes over solid rock and is comparatively very shallow Seven hundred and fifty feet is an enormous depth, second only to the great siphon under the Hudson River which is 1114 feet below the river surface It so happens that the deepest shaft ever sunk in New York city equals the height of the tallest building in the world To illustrate this enormous depth, our artist has taken the liberty of building the Woolworth Building topsy turvy, that is from the ground down at the Clinton Street shaft at the west bank of the East River Enormous as is the building yet it barely reaches the aqueduct at this point Evidently there will be plenty of cellar room over the tunnel and yet it is worth noting the aqueduct follows the street lines so as not to trespass on private property!

Arrived in Brooklyn the aqueduct rises again to within two or three hundred feet of the surface and is pushed as far as it is possible to carry it in solid rock and yet communicate with the surface This limit was found to be at the junction of Flatbush and Third avenues. Here it was necessary to go through 215 feet of overlying earth before coming to the rock The caisson method had to be resorted to and the caisson was sunk over 100 feet below the water line before rock was reached Considerable difficulty was here experienced in sinking the shaft to the rock because it called for the use of pneumatic pressure that taxed the endurance of the workmen to the limit From here on the water will be conducted through pipes laid in a trench of a moderate depth below the surface From the foot of Seventy-ninth Street Bay Ridge the conduit will be run across the Narrows to Staten Island through a pipe 36 inches in diameter provided with flexible joints and laid in a submarine trench The details of this section of the work have not yet been given out However tests have been made to discover at what depth the pipe line under the water must be buried It is evident that it must lie far enough below ground to prevent its being entangled with anchors from large vessels that may have to anchor in the Narrows The matter has been thoroughly investigated and practical tests have been made by dragging anchors of large size along the bottom It has been determined that if the pipe line is buried at least eight feet under the bed it will be entirely safe On the Staten Island side a 48-inch pipe will carry the water on up the hill and through a tunnel into Silver Lake reservoir 120 miles from the source in the Catskills.

The greatest interest in this city section of the aqueduct attaches naturally to that part which is being excavated through solid rock under the busy city It is a surprising fact that a work of such magnitude can



"Holed through" from shaft 16 to shaft 17. Dangerous rock overhead due to vertical seams.

Permanent channel iron support for a treacherous roof. The beams will be imbedded in the concrete lining.

be carried on directly under our feet without inconveniencing us in the least. The only surface evidence of the deep rock tunneling is to be found at the various shafts which are located in parks or public squares. The principal difficulty that presented itself at first was the question of storing explosives for a work of such great proportions. To keep the necessary explosives on the surface was to harbor constant menaces to the lives of the citizens. The matter was finally solved by placing the dynamite magazines far under the surface in the rock and setting the doors to these magazines so they will automatically close in case of an explosion and trap the hot and poisonous fumes in the rock chamber where they can do no harm to the workmen. The idea was borrowed from European practice where mining operations are conducted close to and sometimes directly under large cities. Access to the dynamite chamber is had through a zigzag drift. At each turn of the drift a pocket is excavated, and the chamber itself is made of large capacity. In this chamber the dynamite is stored under a protecting roof to keep off any fragments of rocks that might fall when jarred by the shooting in the tunnel. At the entrance of the drift a very substantial concrete bulkhead is built and in this is a low doorway. The door is of massive construction built of I-beams sixteen inches deep and spaced apart with oak beams twelve inches square. The door has beveled edges, so that it will seat itself snugly in the doorway. The door is always kept open at an angle of about 15 degrees. In the magazine a thousand pounds of dynamite may be kept at a time. Should this be exploded, the explosion wave would have to travel down the zigzag passage and would lose much of its force at each abrupt turn, finally striking the door with greatly diminished energy. The door would be slammed shut by the blast of air issuing from the drift and would then be held shut by the gases of the exploded dynamite. A magazine of this sort has been constructed near the foot of each shaft—not at the foot however, for fear that in case of a mishap it might block the escape of the men. The magazines have been tested by exploding a number of sticks of dynamite around the first bend in the drift, and in every case the door has closed just as expected.

The work through the rock is being pushed very rapidly, at some of the shafts between 800 and 1,000 pounds of dynamite have been used daily. Within the last year millions of pounds of dynamite have been exploded under the city, while most of New York was totally oblivious to the fact. Already a number of the tunnel sections have been "holed" through. To expedite the work, one contractor is using an interesting form of shoveling machine built especially for this work so that it may be taken down the comparatively narrow shaft and be assembled to work within the small diameter of eleven feet, which is the size of the tunnel at the particular point where this machine is now being used. A photograph of this machine is shown herewith, and also a drawing illustrating the mechanism. The machine is controlled by a single operator and does the work of six laborers. It is provided with a double shovel A and B. The section A digs up the rock and throws it upon the scoop B, which in turn empties its load upon a traveling chain conveyor C, the latter delivers the load into muck cars at the back of the shoveling machine. The letters B, B^1, B^2, and B^3 show the successive positions of the scoop. The forward section A is carried upon a crank shaft D, which is revolved through the arc indicated by the arrow. Another arrow line shows the course of the front edge of the section A. The forward end of the scoop B rests upon the heel of the section A, while its rear end is mounted upon a shaft E, which travels in a guideway F. The forward section A is connected to the shaft E by means of side plates, indicated by dotted lines, so that as the crank shaft D revolves, the slide shaft E is obliged to run up the ways F, as indicated by the letters E^1, E^2, and E^3. The section B is equipped with a small arm G, which carries a roller that is adapted to engage the cam groove H, causing the scoop B to turn over as indicated in the dotted view B^3 and empty its load upon the traveling conveyor. The machine is mounted on a turntable, so that it may be turned about in any direction.

Looking down the 441-foot shaft at 149th Street.

Reinforcement for the caisson at Flatbush and Third avenues.

Shoveling machine for removing the broken rock and loading it into cars.

Some of the work on the city pressure tunnel has been hurried so far that certain sections are now being lined with concrete. The forms used for this purpose are very interesting. Our front page illustration shows their construction. They cover 120 feet altogether and are arranged in two sections, sixty feet of the lower half of the tunnel being concreted in an advance of sixty feet of the upper part. The first step is to lay the "invert," that is, a narrow segment of the lining running along the bottom of the tunnel. This,

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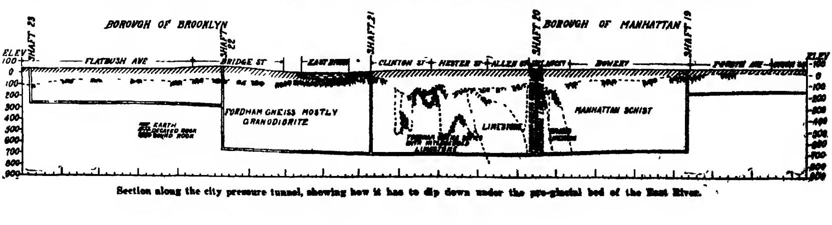


Section along the city pressure tunnel, showing how it has to dip down under the pre-glacial bed of the East River.

The Heavens in March

Eclipse of a Star by One of Jupiter's Moons

By Henry Norris Russell, Ph D

A VERY unusual piece of astronomical work, from a part of the world in which little has previously been done, deserves description this month. Though published in the German *Astronomische Nachrichten*, it originates in Chile where Dr Ristenpart a German astronomer of distinction, is in charge of the observatory at Santiago.

On the night of August 13th, 1911, the third satellite of Jupiter Ganymede, passed directly in front of a star of the seventh magnitude, in the constellation Virgo, and for observers in the southern part of the Earth, actually hid the star for more than four minutes.

The circumstances of this remarkable occultation were carefully calculated in advance by Banachiewicz, and it appeared that the best observing stations would be in South America Dr Ristenpart, with great energy, set about the organisation of observers throughout Chile, and it is undoubtedly due to his zeal and forethought that the important results which we are to describe were obtained.

Why it was important to have observations made at as many places as possible appears from the fact that since Ganymede is much smaller than the Earth, its shadow if we may so describe the region from which at any moment it conceals the star is only a little more than 4,000 miles in diameter

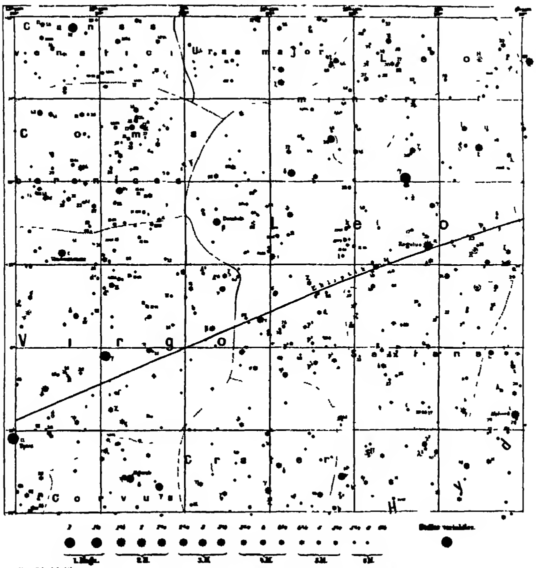
As Jupiter and its satellite moved, this 'shadow crossed the Earth its center passing over the southern extremity of South America a little north of the Straits of Magellan while its northern limit reached barely to the boundary between Chile and Peru Observers at southern stations would therefore see the satellite pass almost centrally over the star while for those in northern Chile, the latter would be concealed for a much shorter time behind the northern edge of Ganymede

By comparison of the duration of the occultation as seen from different places, it should therefore be possible to obtain very accurate information regarding the size and shape of the eclipsing body In spite of unfavorable weather and other difficulties, the various observers—mostly school teachers or amateur astronomers—were able to obtain reliable observations at five stations, extending almost along the same meridian for 1,000 miles. Except at Santiago, the observers had only small telescopes of about four inch aperture, with which the satellite could not be distinguished, as regards its appearance, from the star, except that it was a little brighter The two came closer together until they could no longer be distinguished, but formed one mass of light. Then, suddenly, the light diminished to about one half, this being, of course, the real instant when the star vanished behind the satellite. After a time the light increased again as the star came out, and then the mass of light gradually separated into two points.

In addition to these visual observations a number of photographs were obtained by Dr Zurbellen, which defined very accurately the relative positions of the star and satellite before and after their conjunction, and made it possible to calculate just how far apart they must have appeared at any time.

Working along these lines, Dr Ristenpart finds that, in order to get a satisfactory agreement between theory and observation it is necessary to assume that the satellite, like Jupiter itself, is flattened at the poles, for otherwise the calculated length of the occultation at the northernmost station, where the star appeared to pass just inside the satellite's disk would be much longer than the observed time As the rate of motion of the satellite is accurately known the maximum length of the occultation affords a very precise measure of its diameter Dr Ristenpart finally concludes that the equatorial diameter of the satellite is 4 700 miles, and the polar diameter 4,300, so that it is a little more flattened in proportion to its size than Jupiter himself. The diameter of the satellite was previously supposed, from micrometer measures, to be about 3 000 miles, and the difference between this and the new value is surprisingly large, but owing to the method of observation Dr Ristenpart's results seem to be entitled to very serious consideration The mass of this satellite is known, from its attraction on the other satellites to be about 1/12,000 that of Jupiter or a little more than 1/4 that of Mars. But, according to the results just given it is a little larger than Mars. This would make its density less than ½ that of Mars, and actually less than that of water—intermediate between the densities of Jupiter and Saturn. Even with this low density, it must be in rapid rotation with a period not more than ten or twelve hours, to account for the polar flattening.

It is perhaps most interesting of all to note that, according to the most definite of the observations, the disappearance of the star behind the satellite was almost instantaneous, the loss of light lasting only a second or so. This means that the apparent diameter of the star was not more than 1/300 that of the satellite, in other words, less than 1/500 of a second of arc This is quite what is to be expected for a star of the seventh magnitude, but it is interesting to have the extreme smallness of the apparent diameter of a star confirmed by direct observation.



From Schurig's Atlas

THE HEAVENS IN THE REGION OF LEO AND VIRGO

The Heavens.

We give again this month a detail map showing a portion of the sky which is now favorably placed for evening observation. Any one familiar with the constellations can easily pick out upon it the Sickle of Leo toward the west – that is, on the right for on maps of the sky toward which we look *upward* the position of east and west if the north is at the top is necessarily different from what they would be on maps of the Earth's surface at which we always look downward

Among objects of telescopic interest here are Gamma Leonis, in the Sickle a very well known binary pair, now separated by 15 seconds, and in very slow motion so that a complete revolution can hardly take less than 1000 years The bright star Regulus, at the end of the handle of the Sickle,' has a companion of the eighth magnitude a little less than 3 minutes away which in spite of its great distance from its primary shares the proper motion of the latter and is doubtless really as near it as it appears to be Fifty four Leonis in the northern part of the constellation, is a pretty pair with components of the fourth and sixth magnitudes 6 minutes apart

South and east in Virgo the star γ is a famous binary which has been followed for the greater part of its period of one hundred and ninety years At present the two stars are at their widest separation about 6 seconds apart and can be separated with a very small telescope as can the pairs previously mentioned In 1836, however they were less than one tenth as far apart as now and could only be divided by the most powerful instruments of that day

ξ Ursae Majoris which may be found near the northern edge of the map just north of δ Leonis, is another very fine binary pair with a period of sixty years The components are now at their greatest separation—nearly 3 seconds and can be resolved by instruments of very moderate power

The Planets.

Mercury is evening star until the 27th when he passes through inferior conjunction and becomes a morning star He may best be seen about the 10th, when he sets about 7 30 P M Though only 18 degrees from the Sun he is north of him, and very bright (excelling Vega or Arcturus) and being in Pisces, in a region very poor in bright stars, can easily be identified.

Venus is evening star too at her greatest brilliancy appearing about twelve times as bright as Sirius and more than 100 times as bright as Aldebaran She casts a conspicuous shadow If her light is allowed to shine through a window into a darkened room and can be easily seen in the daytime if one knows just where to look Shortly before sunset any one can pick her up, high in the western sky while the Sun is still shining.

At the beginning of March she sets about 9 30 P M and remains in sight until nearly 10 o'clock at the end of the month.

Mars is a morning star in Capricornus, rising about 5 A M Jupiter is likewise a morning star but is further east, in Sagittarius, and rises about 2 15 A M in the middle of the month. Saturn is evening star in

(Concluded on page 215.)

The Turcat-Méry torpedo, with hood removed.

The Turcat-Méry torpedo, with canvas hood.

Queer Automobile Bodies

Some Interesting French Designs

THE development of automobiling has been attended by a corresponding development in the construction of automobile bodies, even by an overdevelopment, which has produced queer forms that depart widely from the conventional types although they are not always unpractical or destitute of merit.

Most of these queer looking automobiles are of French make. A well known example is the Grégoire "submarine" which conceals all but the head of the driver. The same firm makes a still more realistic "submarine" which is provided with a conning tower and completely incloses the driver. Then there are cars shaped like artillery shells, with rounded tail pieces in which extra wheels or tires are neatly stowed, and other shell types with glass skylights.

Three novel and bizarre automobile bodies of French make are described and illustrated in the present article taken from the *Allgemeine Automobil Zeitung*. The first is a Turcat-Méry body which is called "The Shark" because it strikingly resembles that fish, especially when seen from in front, owing to the peculiar combination of the lanterns with the mud guards. This constructive device was first suggested in a Napier car which was shown at the last Olympia exhibition in London, and in which the front lanterns were mounted on the ends of the guards. The next development was the mounting of the top lantern on one of the rear mud guards. Finally an ingenious constructor conceived the idea of incorporating the lanterns with, instead of mounting them on the guards. This construction is certainly queer, but it is eminently practical if it is solidly and substantially executed, because the lanterns sharply mark the two extreme front points of the car.

The other two cars herewith illustrated represent two solutions of the problem which many constructors have attacked with more or less success, of producing an open car which can be converted into a closed one without showing at all times the mechanism and the additional parts by which the transformation is effected.

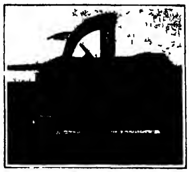
One of these vehicles, the "torpedo" made by Turcat-Méry, is provided with a canvas cover which can be entirely concealed in the body of the open car so that the graceful lines of the torpedo are not marred. This cover affords complete protection and is provided with glass windows.

Still more ingenious is the Phenix officially designated "*Torpedo conduite intérieure Phénix à décapotage complet*," i. e., a torpedo-shaped Phenix car controlled from the inside of a hood which can be made to disappear completely. Two-seated closed cars controlled from the inside are now very popular and in many styles, some of which are very luxurious and costly. The new Phenix car appears to furnish every possible gradation between the completely closed and the entirely open vehicle. It also presents a very graceful appearance, and its lines show originality. The hood is composed of two quarter cylinders, which turn in pivots and can be raised and lowered separately.

The sides of the hood are glazed, and there is a hinged glass window in its convex front. Behind the hood is a disappearing seat for a servant. The front part alone gives sufficient protection against an unpleasant head wind in otherwise agreeable weather. When the front part is dropped a small portion of it remains to form a wind shield of the usual type.

New Phenix car, entirely open.

Hood of new Phenix car, closed.



Hood of new Phenix car, half closed.

Front view of "The Shark."

After part of "The Shark."

"The Shark," so named because the peculiar combination of the lanterns with the mud-guards suggests a monster of the deep.

Treating Table Refuse for Animal Food

A SOMEWHAT original method of securing food for animals from otherwise wasted substances is now being applied in Germany, and it appears to be worthy of note on account of the economy which could thus be secured. At Charlottenburg the city regulations require that all remains of food be placed apart from other household waste, such remains being collected separately each day and taken to a special plant, where they are treated so as to obtain a food product. They are first freed from all non-nutritious matter which is always present, then the material is ground, pressed and dried and finally transformed into a kind of meal which is sold under the name of "bread meal." This is used in the original state or mixed with molasses. It is fairly nutritive but has a large percentage of ash, this being due to the large quantity of bones contained in the waste material. M. Hansen made experiments with the meal in feeding milch cows, and his tests bore upon 76 head divided into three lots, lasting for over three months. The results were encouraging and he considers that the meal should be used alone without mixing with other substances. He brings out the advantages which would be obtained in the way of economy and figures that should such a method be applied in German cities of over 200,000 inhabitants each, totaling 9,000,000 population, the yearly product would be valued at $2,500,000 for stock raising purposes.

Sharpening a Pencil

AN expert manual training man talked with the writer about so simple a thing as sharpening a lead pencil. In the first place, he says, the knife should not be over sharp, but should be a little dull, as if too sharp it will cut quickly through the wood and cut away the lead. If you remember, that is just the way a keen blade will use up a pencil. Then again, he says, it is best to hold the pencil in the left hand with the end to be sharpened pointing away from you and to cut away with a pushing cut, rather than toward you with a drawing cut, as when the point of the pencil is rested against the side of the thumb and is sharpened by a draw cut stroke of the knife blade.

Floating Civic Arts Building

AN interesting and thoroughly modern suggestion is given by a "sketch model of a proposed Civic Arts Building" at the exhibition of the Architectural League, 215 West Fifty-seventh Street. Made to scale it would be a circular building about 450 feet in diameter, with a well proportioned colonnade of early Doric type encircling it, and with a portico at the principal entrance.

This structure, rising abruptly from the water, suggests that the building occupies an island site, but it is in reality upon a buoyant concrete foundation. The foundation has the form of a great double walled bowl with ledges built in amphitheater form on the inner wall on which would be placed regular theater seats. The inner shell of the bowl is a segment of a sphere of smaller radius than the outer one and contacts with it at the lowest point. From this point a dozen or more vertical walls, connecting the two, radiate to the circumference, dividing the intervening space into as many water tight compartments.

This building is proposed as a desirable city enterprise for the maintenance of a civic theater, concert hall, arts and crafts schools, exhibitions and competitions, the discussion of civic public art and other matters—in a word the art and civic center of the people, to be moored at some such accessible point on the water front as Battery Park, where mooring privileges are controlled by the municipality.

The plan creates at no cost a site more desirable than $5,000,000 could secure.

It is the conception of Robert Paine, a sculptor of decided character and originality with a natural affinity for engineering activities, who has several other practical achievements to his credit among which is the sculptor's pointing or enlarging machine.

Proposed floating Civic Arts Building to be moored on the water front.

Rear of the building showing the bowl-shaped buoyant foundation.

Friction of Gas Flow in Pipes

IT is not the intention of this article to impugn the accuracy of the formulæ of Weisbach, Rankine and others with regard to the friction of steam flow in pipes but whether through neglect of the principles laid down by these authorities, or through improper and unintelligent application of them certain it is that there are to-day in what is called "successful operation" many power plants which show on careful analysis of steam meter and other records a loss of power in the piping system which is truly appalling.

A striking illustration of the effects of pipe friction came recently to the writer's attention in the course of some experiments on a medium sized vacuum cleaner such as would be installed in the basement of a forty room dormitory building. Several cleaners of rival makes were being considered, and as all operated on sweeping tests about equally well, it was determined to conduct accurate and thorough tests on each.

With this end in view, a tube of galvanized iron, No. 20 gage, ten feet long and of six inches internal diameter, was fitted at either end with a cone of the same metal, terminating in an opening of 1½ inch internal diameter. Measuring devices being fitted to the cylinder for determining the volume of air delivered to the machine, one of the cone ends was attached directly to the machine, and to the other was coupled ten feet of reinforced rubber suction hose of 1½-inch internal diameter. The end of this latter hose was open and fitted with a coupling to take the various sweeping tools.

The pump being started, the first run was made by detaching this suction hose from the cylinder, in order to get the free delivery volume, velocity, etc. The hose was then attached, with the intention of attaching the various tools to determine their resistance to the admission of air. The pump being again started, with the hose end open, the gage showed about five inches of vacuum when the tube suddenly and completely collapsed, as is shown in the photograph. The iron pipe on which the collapsed tube rests, was later substituted for the latter, and the general arrangements are clearly shown in the cut.

The cause for the collapse of the tin tube could be nothing else than the creation of a vacuum within the cylinder because of the resistance of the ten feet of open hose as the cylinder without the hose withstood the pressure without difficulty. Had the end of the hose been closed in part by the attachment of a sweeping tool, the result might have been expected. Further this collapse was occasioned by the friction of air at comparatively low velocity. To how much greater degree, then must friction be present in pipes through which steam is rushing at high velocity and how especially pronounced must be this effect when it encounters a right angle elbow?

Tin pipe collapsed by vacuum produced by friction of air

The Three-wheeled Tractor

THE vital problem of satisfying the ever increasing demand for trucks of larger capacity has led to the advent of the three-axle tractor trailer method of transportation in which all the propelling mechanism is carried entirely separate from the load-carrying portion. One of the important advantages of this method is the economy in tires and wear and tear of the mechanism. The major portion of the load is not carried on rubber tires but on the steel shod wheels of the trailer which saving alone would pay half the total expense of the largest truck.

A rear wheel drive machine has a tendency to push the front wheels down into the road surface; a front wheel drive pulls the rear wheels up and over. This difference in tendency is so marked that the same power plant, gear ratio and propelling mechanism will give far greater results in speed and pulling ability in a tractor than in a truck.

With a single tractor several trailers may be used, one being delivered while another is being loaded and a third being unloaded, thereby keeping the motor part active all the time; or special unloading trailers may be used in some such lines as coal, ashes, garbage, etc. One dealer having delivered with a chute body ten loads of nine tons each to a distance of three miles, making the enormous total of 270 ton miles for one day. A certain development company uses a twenty yard trailer, receiving a 17 or 20-ton load from a chute and emptying by dumping, each operation taking less than a minute. Such large units are easily handled by using a single steering wheel. The wheel may be turned to at least 80 degrees, pivoting the unit at or near the fifth wheel, the entire vehicle being capable of turning around in a twenty two foot street.

Tractor leaving its trailer to be unloaded while it returns to the coal yard with an "empty"

A Bicycle Automobile

A TWO-WHEEL automobile of unique design has recently been perfected by a western man which differs greatly in its construction from a motorcycle. In fact, the two have little in common. It is like an ordinary automobile with the exception of the number of wheels.

There are two runners under the foot board and when the operator releases his hold on the steering wheel these runners automatically let down on the ground and keep the machine in an upright position. The wind shield is a small oval shaped glass with a convex surface to the wind large enough to protect the driver's face.

The radial frame, rear wheel suspension adds to the comfort of the passenger while an entirely different system of springs is used on the front wheel. The steering knuckles not only turn the wheel but shift the center of gravity making easy steering.

The engine is 3-inch by 4-inch two-cylinder two-cycle valveless type of eight horse-power and an excellent muffler makes silent running.

Although the photograph shows only a one-passenger car, it can be used for two persons by adding a seat over the rear wheel. This is a regular cushioned seat like the front one. One can also adjust a deck over the rear wheel and use the automobile for delivery purposes.

A two-wheeled automobile.

RECENTLY PATENTED INVENTIONS

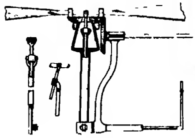
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

HAT.—J. HUTTER, care of Benj. Wertheimer & Co., 656 Broadway, N. Y., N. Y. The object here is to provide a structure which may be readily creased or folded without injury, whereby a hat may be trimmed while in an extended position and then collapsed to take the finished position or the position desired.

Pertaining to Aviation.

FLYING MACHINE.—E. E. PORTER, 808 Realty Bldg., Charlotte, N. C. In this machine the turbine or aerial screw propeller is revolved either horizontally or vertically for the purposes of both supporting and propelling. The construction of the aerial screw propeller by which a single screw is made to do the sup-



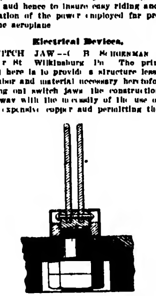
FLYING MACHINE.

porting and propelling consists in automatically oscillating the blades during each revolution and decreasing the pitch in like amount on its opposite side, so that this form of screw has constantly a greater pitch and a greater pull on one side of its rotation than on the opposite side. The screw is thus unbalanced and a sidewise thrust is exerted in addition to and at right angles to the normal thrust of the screw.

AEROPLANE.—H. W. ODLIN, care of Frank T. Burke, Jr., 340 W. 80th St., New York, N. Y. This invention provides an aeroplane arranged to automatically maintain its equilibrium and thus prevent capsizing in heavy winds, or when struck by sudden gusts of wind and hence to insure easy riding and full utilization of the power employed for propelling the aeroplane.

Electrical Devices.

SWITCH JAW.—C. B. SCHOENMAN, 1318 Hunter St., Wilkinsburg, Pa. The principal object here is to provide a structure lessening the labor and material necessary heretofore in turning out switch jaws, the construction doing away with the necessity of the use of the more expensive copper and permitting the use

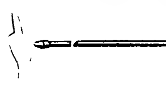


SWITCH JAW

of other metals. The invention relates generally to structures used in electrical work and more particularly to a jaw especially adapted for use with knife switches, fuses and the like.

Of Interest to Farmers.

IMPLEMENT FOR CUTTING AND HANDLING PRICKLY PEAR.—H. H. BROWN, J. O. Box 327, San Antonio, Tex. This invention pertains to implements for clearing the ground



IMPLEMENT FOR CUTTING AND HANDLING PRICKLY PEAR

for purposes of cultivation, the object being to provide an implement which may be easily and quickly handled for the purpose of cutting and handling prickly pear. Broadly the improvement consists in the provision of an implement which embodies a handle and a transversely elongated head at one end of the handle having an outer cutting edge and an engaging prong or tine extending from one side thereof.

BOLL WEEVIL CATCHER.—B. O. HUBBARD, Raymond, Miss. An object of this inventor is to provide a device for catching boll weevils and for simultaneously cultivating the cotton plants, and further to provide a novel form of means for knocking the boll weevil from the cotton plants without injuring the latter.

FRUIT PICKER.—A. H. GILLNESS, Suttons Bay, Mich. In this invention the object is to provide a device for picking fruit which will prevent bruising of the fruit. A further object is to provide a device by means of which fruit

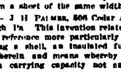
FRUIT PICKER.

in the highest part of the tree may be picked as well as that on the lowest. A further object of the inventor is to provide a device which can be manufactured cheaply for accomplishing the above named results.

Of General Interest.

ENVELOP.—W. F. CROWELL, 39 Wood St., Providence, R. I. The invention provides an envelop made from a sheet of paper of small form width, thus saving paper material in the manufacture of the envelop, dispensing with the use of special dies to form the blanks, and allowing the formation of envelops of different sizes from a sheet of the same width.

FUSE.—J. H. PALMER, 806 Cedar Ave., N. S., Pittsburgh, Pa. This invention relates to fuses and has reference more particularly to a fuse comprising a shell, an insulated fusible conductor therein and means whereby a conductor of a carrying capacity not exceeding a



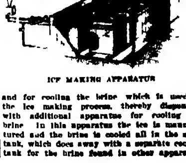
FUSE.

predetermined value can be introduced into the shell. An object is to provide an inexpensive, simple and durable fuse in which the fusible conductor can be easily replaced by a new one of the same carrying capacity or one not exceeding a predeterminate carrying capacity.

CARD INDEX.—D. F. CARVER, 95 Liberty St., New York, N. Y. The main object of this invention is to provide cards with means whereby they will be caused to present themselves in single succession with adjacent cards so spaced apart at the upper edges that at least the heading of each card can be clearly read in succession. The operator is enabled to readily control the cards so as to cause them to be thrown forward in single succession toward the operator each moving forwardly separate and distinct from the one in front and the one behind it.

LENS SYSTEM.—R. D. GRAY, Ridgewood, N. J. This invention relates to photographic objectives and the object is to provide a system more especially designed for use in objectives of telephotographic cameras and arranged to overcome astigmatism, curved field, spherical and chromatic aberration and other defects, such as are frequently found in lenses used in apparatus of this class.

ICE MAKING APPARATUS.—S. R. BELL, 408 Walnut St., Beaumont, Tex. This invention has reference to ice making apparatus, and it has for its purpose the provision of one having combined means for making the ice

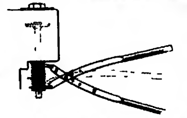


ICE MAKING APPARATUS

and for cooling the brine which is used in the ice making process, thereby dispensing with additional apparatus for cooling the brine. In this apparatus the ice is manufactured and the brine is cooled all in the same tank, which does away with a separate cooling tank for the brine found in other apparatus. The engraving is a perspective view partly in section, showing the ice-making apparatus.

Hardware and Tools.

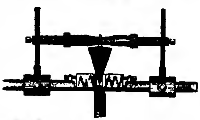
TOOL FOR COMPRESSING VALVE SPRINGS.—C. MYERS, care of Summit & Downee, Huntington, N. Y. In this case the invention pertains to tools for compressing valve springs, and the aim is to provide one with two members, one being disposed in an elongated slot in the other with means by which the two members may be readily pivoted together in adjusted position. Each of the members has a forked terminal disposed at an angle to the body of the member and the members may be readily pivoted together with the



TOOL FOR COMPRESSING VALVE SPRINGS

terminals converging or diverging or if desired the members may be pivoted together with the terminals extended in the same direction and substantially parallel.

REAMER ATTACHMENT FOR DIE STOCKS.—H. BLOOMINGTON, 1609 O'Farrell St., San Francisco, Cal. The invention refers to a reamer attachment for die stocks, and has reference more particularly to a device which comprises an adjustable reamer supporting member adjustably supported on the die stock. The invention provides an inex-



REAMER ATTACHMENT FOR DIE STOCKS

pensive tool which can be easily mounted on any die stock and which will ream the interior extremity of a pipe simultaneously with the threading of the same exteriorly. This improved tool will ream pipes of different sizes without changing the reamer secured thereto.

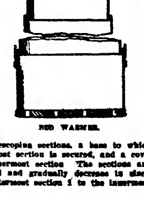
TOOL.—J. STURTEVANT and J. I. WEINZIERL, 1100 3rd Ave., New Kensington, Pa. This invention is more particularly intended for embodiment in detachable handles for cooking utensils, but is capable of embodiment in pliers and other gripping devices. A spring between the crossed handles of a pair of gripping jaws tends to close the jaws, a novel ratchet and spring pawl on the handles hold the jaws in closed position.

Heating and Lighting.

HEATER.—B. COLEMAN, 696 E. 161st St., Bronx, N. Y. This improvement is in heaters applied to a gas fixture in a building to provide a ready and convenient source of heat for rooms and apartments, and it comprises features by means of which the stream of gas that is supplied to the heater is impeded upon entering the same and more evenly distributed to the interior of the heater so as to make the heating effect more efficient and more uniform in practice.

Household Utilities.

BED WARMER.—G. F. SHEPARD, P. O. Box 151, Dodge City, Kan. This invention provides a device by means of which heat may be stored from a suitable source of supply and transferred to the bed warming the bed over an area corresponding to the position occupied by the person using the bed and which while not in use may be stored in a small compass. The invention comprises a plurality of similar



BED WARMER.

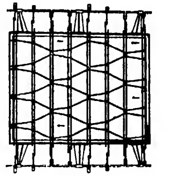
lar telescoping sections, a base to which the outermost section is secured, and a cover for the innermost section. The sections are cylindrical and gradually decrease in size from the outermost section 1 to the innermost section 5, in such manner that the sections fit within one another.

Machines and Mechanical Devices.

RAW STOCK DYEING MACHINE.—S. R. NOAH, Desire Station, Greensboro, N. C. This invention is an improvement in stock dyeing machines, and has for its object the provision of a machine that will take the stock and subject it to a plurality of operations, compressing it after each operation. The device is especially intended for indigo and raw stock.

WIRE STRIPPING MACHINE.—M. PERSIN, 624 E. 13th St., New York, N. Y. The object here is to provide a structure for removing one or more layers of insulation from any desired length of wire. Another object is to provide a structure which will straighten lengths of wire, sever the insulating matter thereon, and then remove the severed portions, each independent part of the insulation being removed to different receptacles.

SINUSOID PROPELLER.—I. J. PADDOCK, Nebraska City, Neb. This invention is based upon the fact that when a flexible surface such as a sheet of fabric, is held at one edge in a current of air or other medium which is traveling in a direction parallel to the normal plane of the sheet, the latter will have imparted to it a series of wave-like motions.



SINUSOID PROPELLER.

These waves follow one another in rapid succession and have the form of a sine curve. Parts of the sheet will be moving upwardly, and other parts will be moving downwardly. An object is to provide a device by means of which the wave-like movements of the sheet may be used for generating power.

AUTOMATIC PUMP.—W. A. HARRIS, 217 John St., Greenville, S. C. This invention relates to improvements in automatic pumps, especially those that are designed to be operated by compressed air. It provides a pump for elevating water which will operate continuously while water is being drawn from a faucet or other outlet, but which will automatically stop after the faucet is closed.

Pertaining to Vehicles.

ATTACHMENT FOR BRAKES.—E. D. SALLTAW, Calhoun, Tenn. This improvement relates to attachments for brakes, and the object is to provide a brake block with two pivoted arms having teeth for engaging and holding the brake shoe in position. The brake block will last indefinitely and the brake shoe may be readily replaced from time to time as required.

Designs.

DESIGN FOR A DRINKING GLASS.—C. HANKS, New Castle, Pa. This ornamental design represents a glass of average elevation in height and curving inward from the top to the middle, thence swelling to the base in very graceful outline. The glass is very neatly embellished with ornamental patterns.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Supplying a Metropolis with Mountain Water

(Concluded from page 208)

when completed, forms the track upon which the forms for the rest of the lining travel The forms are mounted on trucks with wheels tapered to fit the curve of the invert. The forms for the lower half cylinder are practically the same as those for the upper half cylinder After the lining has set the sides of the upper form may be drawn in to free them from the concrete, by operating the turnbuckles *A*, and those of the lower forms by operating the turnbuckles *B* Then jacks may be unscrewed to lower the upper section slightly, freeing it completely from the concrete and jacks *E* may be screwed up to raise the bottom section slightly upon the truck. In this collapsed condition the forms may be drawn forward to complete the next section of tunnel The detail view in the front page drawing shows how the lower forms are supported on the trucks. To the longitudinal beams *C*, vertical guides *D* are bolted, which fit against the framework of the truck The jacks *E* mounted on the truck bear against cross pieces running from *C* to *C* The filling of the lower half of the forms is comparatively simple It is quite a different task, however, to lay the concrete into the upper form Sections of the plating of the upper forms are removed and the concrete is shoveled in adding the plates step by step as necessary, until finally the topmost plate is added when the concrete can be introduced only from the end of the form It will be observed that small pieces of board are temporarily nailed against the edge of the forms and fitted up as neatly as possible against the rock above, so as to retain the concrete until it sets. As each section is completed, grouting holes are left in the top through which, when the lining is completed otherwise grout will be forced under high pressure to fill up all cracks and crevices and make the lining perfectly sound.

At each shaft access will be had to the tunnel through risers or vertical pipes, 48 or 72 inches in diameter At most of the shafts two such pipes will be provided, each fitted with valves at the bottom which may be operated from the surface to close either of them when it is desired to gain access to them or to effect any necessary repairs. The valves at the bottom of the risers will be of such a design as to close automatically in case of an abnormal flow through the risers, due to the destruction of the valve at the top by explosion or other accident. At the top of the risers there will be two valves, the one nearer the riser being an emergency valve, which may be closed in case of any damage to the other valve.

It is probable that no immediate changes will be made in the water supply of Manhattan and Bronx, except that pipe lines will be run from the shafts to help out the existing supply in case of emergency In Brooklyn and Queens, where thirty five pumping stations are now required, most of the stations will be discontinued for the reason that the water will be delivered through the aqueduct at sufficient pressure to reach practically all parts. Only in one or two sections will pumping be necessary

From Hill View reservoir the water will flow through a tunnel, 15 feet in diameter This will be narrowed to 14, 13, 12 and 11 feet, which is the diameter of the rock tunnel at Fort Greene Park, Brooklyn, and at the intersection of Flatbush and Third avenues. From there on steel pipes, five and one half feet in diameter and running down to four feet in diameter will carry the water to the Narrows, and under New York Bay, at the Narrows, the line will be only three feet in diameter This gradual shrinking of the aqueduct reminds one of those large rivers that flow out of the mountains in sufficient volume to be navigable and even a menace to the surrounding country in time of flood, but which, when they reach the deserts are drunk up by the thirsty sands and sucked by the torrid sun until they vanish without any clearly defined terminus or possibly flow in a sickly stream

INQUIRY COLUMN

Inquiry No. 9288. Wanted the names and addresses of concerns that can cast steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9289 Wanted substance melting at 338° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oil, or fatty vapor

Inquiry No. 9290 Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes, namely, to fold up bills and insert them with minor coins in a pay envelope of the usual size.

Inquiry No. 9291 Want to buy machinery for manufacturing wooden tooth picks.

Inquiry No. 9292 Wanted a gum that will stick labels to grape-fruit.

Inquiry No. 9293. Wanted the names and addresses of manufacturers of waterproof cloth, also samples of such cloth

Inquiry No. 9294. Wanted to buy glass tubing [illegible]

[illegible]

to a small stagnant lagoon. Thus, when the entire Catskill system is completed and operating at its full capacity, the waters which three days before poured out of the Ashokan reservoir in a mighty flood, over seventeen feet in diameter, will reach Staten Island, a stream only 3 per cent of its former size after having been robbed by the rest of the thirsty city

Friedmann's New Tuberculosis Remedy *

By H J Archard, M D.

IT need hardly be said that Dr Friedmann's remedy is not a serum, but a bacterin or vaccine, since it is prepared from tubercle bacilli He admitted the origin of his tubercle bacilli (turtle) under pressure but he refused and still refuses to communicate his method. Although he denies that his tubercle bacilli are originally human, he does not say how he obtained his turtle tubercle bacilli or how he infects the turtles. He denies that he uses the old strain of originally human turtle bacillus with which he worked in Piorkowsky's laboratory some years ago.

If we examine Friedmann's report, what do we find? In his original report, which was published in the *Berliner klinische Wochenschrift* for November 18th, 1912, he describes at length his clinical results in a great variety of tuberculous cases treated with his remedy, by intramuscular and intravenous injection sometimes one or the other, sometimes both simultaneously He asserts that patients show surprising improvement after one or two injections He injects his bacterin into newborn infants, although it contains living tubercle bacilli and says that somewhat over one year after this inoculation not the slightest trace of scrofula or tuberculosis is to be found in any of these children

The account of animal experiments is extremely scant Friedmann avers that his preparation is innocuous for guinea pigs, and that even after years they remain quite healthy Nevertheless, they are not entirely immune to severe artificial infection while his untreated animals succumb to this after about 110 days, guinea pigs immunized with one injection live an average of 201 days. He passes over this comparatively unfavorable result by declaring airily that, fortunately conditions are much more favorable in man since tuberculous infection in human beings is never as severe as artificial infection in guinea pigs.

In the discussion before the *Berliner medizinische Gesellschaft*, which is one of the most searching, most severe, and mostly highly scientific tribunals before which a medical man can come Friedmann's clinical results were confirmed by a number of clinicians, although Blaschko and also Heymann showed only indifferent results in cases of skin tuberculosis and lupus. Citron admits that for treatment and for prophylaxis the use of living germs is correct in principle and was adopted by Jenner and Pasteur, but he insists that great care must be exercised as long as the details of Friedmann's method are not known, he referred to Pasteur's experience with chicken cholera vaccine in which the avirulent virus became virulent and caused destructive epidemics. He says "As long as we do not know the nature of virulence, as long as we are not able to control virulence, but may be confronted at any time with the fact that an avirulent virus has become virulent for some unknown reason, so long we have all been afraid to employ this principle of living virus in man, however much we may agree in principle with Friedmann, that living virus should be employed."

Citron objects to the introduction of an unknown remedy which contains living virus into children who are not clinically tuberculous, although he can find an excuse for the administration of such a rem-

* Abstract of an address opening the discussion on the subject before the North Shore Branch of the Chicago Medical Society, February 4th, 1913.

edy as a last resort in severe tuberculous cases. He warns against the general use of the remedy until Friedmann has clearly stated of what his material consists. He refers to the relatively unfavorable animal experiments, which he calls failures.

Prof Orth reports that the animal experiments did not yield absolutely good results The immunized animals did not live much longer than the control animals. They all acquired tuberculosis.

Felix Klemperer's discussion which was largely historical and along general lines, is immensely interesting but it would lead too far to repeat it, even in abstract He does not believe that *the* curative remedy against tuberculosis has been found, that tuberculosis has been practically eradicated, as was announced by one of the gentlemen in the discussion, but he insists that essential progress has been made He shows the importance of the suppurative action of tuberculin even of Friedmann's turtle tubercle bacilli, which had rendered earlier experiments at immunization futile He asks how Friedmann's remedy has been deprived of this action of producing pus. Klemperer agrees with Citron that prophylactically, i. e for the vaccination of children the use of Friedmann's remedy is rather premature

Goldscheider speaks from the point of view of the practitioner He asserts that the purely clinical improvement which has been described in the cases treated is not sufficient and demands documentary and far better proof than has yet been afforded of the actual benefit derived from the remedy

In the further discussion in which such men as Wolff Eisner Bier and Goldberg took part, similar reasons were advanced for exercising great care and for waiting Schwenk denied that a case of renal tuberculosis which Friedmann had declared to be cured had been improved, in fact he said that the disease was still progressive

When we examine Friedmann's report in detail, we miss first of all the thoroughness and entering into essentials for which Koch's first account of the etiology of tuberculosis has given such a splendid example, and which was followed by other investigators, for instance by Ehrlich in the announcement of his salvarsan Friedmann's account is not satisfactory and must be characterized as empirical far more than scientific At the present day it no longer suffices to say that a remedy has cured or can cure tuberculosis The cure must be established, first by a clinical improvement which may be temporary only and which as a matter of fact has been obtained by other remedies even better than could be done by Friedmann, and has been obtained in this country since 1897, then it must be shown that an actual immunity demonstrable by laboratory tests, by the demonstration of specific antibodies, has been produced, and that this immunity persists for weeks, months, years. It does not appear that Friedmann has made even the simplest serum tests, those for agglutinins, although Koch had shown the way twelve years before and more, and although the behavior of the opsonic curve has been demonstrated conclusively to stand in positive relation to the clinical improvement and to the immunity acquired in the course of treatment

Friedmann's *experimental* proof is pitifully insufficient to establish his contentions. The best he could show was that his experiment animals lived three or four times longer than the controls after virulent infection, while it has been shown with other remedies that experiment animals, notably guinea pigs, absolutely resist a virulent infection to which the controls succumbed in the course of a few months, and that the immunized animals were healthy and free from tuberculosis more than one year after infection.

Although, as pointed out by Citron and other men, the use of living tubercle bacilli is correct in the treatment of tuberculosis in principle, I maintain that the prophylactic use of such material in children and infants is little short of criminal. Friedmann has advanced nothing but his bare assertion that these living tubercle bacilli cannot change in their virulence and become harmful to the children. He can afford no guarantee that he has not infected these children and that eventually they may not acquire a fatal tuberculosis

In spite of all the objections that may be raised against Friedmann's remedy or rather against his administration of it at present, and against his incomplete announcement, I am free to admit that there may be, and probably is, a great deal of good in it We certainly have clinical improvement in a great many cases, which has been confirmed by clinicians and by the physicians in charge We have the disappearance of physical signs the gain in weight the restoration of the working ability the loss of tubercle bacilli in the sputum, even the loss of a positive tuberculin reaction The only question is whether equally good results cannot be obtained with a less questionable because less potentially dangerous remedy This has been done

Dr von Ruck in this country has shown that it is not necessary to inject living tubercle bacilli for the purpose of successful immunization but that a proper combination of the various extractives will accomplish this purpose with equal efficiency and certainly with far greater safety He has even succeeded in removing the suppurative action of the tubercle bacilli by a proper balancing of the content in fats, or perhaps better by removing the excess of fats and waxes from the tubercle bacilli which he had found to be responsible for abscess formation after hypodermic injection

In children who are subjected to prophylactic inoculation with this remedy which, *nota bene*, entails no risk for it does not contain living tubercle bacilli the most surprising clinical improvement was shown especially a decided improvement in nutrition a disappearance of all the clinical signs where they had existed of lung signs of enlarged lymph glands, of anemia, etc and what is more significant the sera of all these children showed a progressive increase in tuberculosis antibodies, agglutinins, amboceptor opsonins Further they showed, and continue to show *lytic power* the power to dissolve tubercle bacilli *in vitro*

The New York Motor Boat Show

THE Motor Boat Show in Madison Square Garden this year was perhaps more than ever chiefly an exhibition of marine engines. There was also a goodly display of boats of various types, though the boats were not so numerous as heretofore The cruisers were represented by two large 40-foot boats, the expensive pleasure craft by a 54-foot Speedway de Visite," having a glass inclosed cabin in the front and a commodious open cockpit in the rear and the speedy runabouts and hydroplanes by a dozen or more boats ranging from 16 to 38 feet in length

As heretofore, the cruisers are fitted with every convenience On account of the high price of gasoline efforts are being made to reduce the fuel consumption to a minimum by means of economical carbureters but there did not seem to be any tendency to use kerosene or crude oil

The hydroplanes, of course, attracted the most attention, especially since they have almost completely taken the place of the displacement type of boat Even that well known builder of steel boats, W H Mullins, has brought out a 16-foot hydroplane hull which, equipped with a 3-cylinder, 2 cycle motor of but 18 to 25 horse-power, is designed to travel at the rate of 28 statute miles an hour, and this all for a moderate price. An ordinary steel launch with inclosed motor in the cockpit can be bought for $300, it is claimed

The hydroplanes were of all types—monoplanes, single-step, and multiple-step. The chief representatives of the second class were the "Baby Reliance II.," winner of one of the three races for the Harmsworth Cup last September, and a new hull, intended to be fitted with two 400 horse-power, 8-cylinder vertical mo-

tors driving twin screws. The multiple-step hydroplane advocated by William H Fauber, was illustrated by 20-foot "Elco-planes" fitted with 150 horse-power and 60 horse-power 8-cylinder and 4-cylinder vertical engines, respectively These boats have made 48.8 miles per hour and 35 miles per hour in tests on Newark Bay Their bottoms are covered with sheet metal having small V-shaped corrugations running lengthwise of the hull, the V's being placed 5 or 6 inches apart. This corrugated metal covering is arranged in 4 and 5 low steps (about an inch) on the low powered and high powered boats, respectively The hull in cross-section forms a wide open V throughout its entire length Longitudinal slots are cut in the vertical sides between the bottom planking and the corrugated sheet metal to let in air and thus keep a vacuum, with its consequent drag, from being produced. The English boat, "Pioneer," which won the international races previously mentioned, was a 5-step Fauber hydroplane. Propelled by two 350 horse-power engines and twin screws she made 43 12 miles per hour in the race as against 42.78 miles per hour scored by the 'Baby Reliance II (fitted with a 150 to 180 horse-power Sterling 8-cylinder 5¼ by 6¾ inch motor) in the race which this boat won

The monoplane type of hydroplane hull in which there is no step, was illustrated by a huge 200 horse-power craft built for an Indianapolis sportsman. A distinctly novel monoplane hull was that of the Viper V,' shown in the basement This hull was just the reverse of the usual hydroplane in that the bottom was deeply concaved from the bow fully half way to the stern—so much so in fact that it is called a sea sled since the sides form what might be called runners. The concavity decreases toward the rear so that the stern is practically flat Twin propellers are mounted on shafts projecting through the vertical stern planking just above the bottom of the boat As only the lower half of the propellers are immersed, they are called surface' propellers. Contrary to the general opinion that a semi submerged propeller is only half as efficient as a totally submerged one, Mr Albert Hickman the designer of this new boat claims that there is only from 6 to 9 per cent slip with surface propellers, while the drag of the shaft, strut, propeller boss, etc (amounting in some cases to 40 per cent of the total resistance) is done away with This boat has outwardly swinging rudder plates hinged to each of its vertical sides. The engine is placed toward the stern instead of in the bow and a generous cockpit is located forward The concave shape of hull is said to be very seaworthy, and also to offer the advantage of trapping the air and forming an air cushion that materially reduces the pounding a hydroplane generally meets with The results obtained with this boat are remarkable A 25 horse-power motor weighing 400 pounds drove a 1,600-pound boat at over 26 miles per hour, while lifting 80 pounds per horse-power This is about four times the efficiency shown by the ordinary hydroplane.

The placing of the motor in a separate compartment in the bow of the boat, which is almost universal this year, makes it difficult to adjust and to start. Consequently either a starting crank is provided in the cockpit or an electric self starting outfit is arranged alongside the motor This latter is a decided improvement, especially where the boat is to be used by ladies, as in addition to the self starting motor, electric lights are provided at night

Achievements and Lessons of the Scott Expedition

IT is, of course, too soon to tell the whole story of what the world has gained through Capt. Robert Scott's second antarctic expedition, in which the heroic leader and four of his companions so cheerfully laid down their lives. The scientific results of his previous expedition (1901 to 1904) filled twelve substantial volumes. It may be years before those of the second expedition are fully

published. Thanks, however, to the journalistic arrangements so admirably worked out in connection with this as with other recent polar enterprises, the salient facts are already before us.

The history of antarctic exploration up to date has comprised two stages. The first extended from the latter part of the eighteenth century to the early years of the twentieth. Some of its great names were Cook, Bellingshausen, Weddell, Balleny, Dumont d'Urville, Wilkes, Ross, Moore, Bruce, Chun, Borchgrevink, Gerlache, Arctowski, Drygalski, Nordenskjold and Charcot. Chronologically this first stage overlaps the second, from which it is distinguished by the fact that its operations were confined almost entirely to the seas surrounding the antarctic continent. Many features of the continent itself were discovered, but nearly always from the decks of vessels, and in many of these discoveries there was a large element of conjecture.

The second stage really took its rise from the meeting of the Sixth International Geographical Congress in London in 1895, when the dissatisfaction of geographers with the previous methods of antarctic research was crystallized in the decision that the actual exploration of the antarctic continent was the most urgent piece of work remaining to be done toward completing our knowledge of the earth's surface; and the means of accomplishing this desideratum were pointed out by Dr. von Neumayer, Sir Joseph Hooker, Sir John Murray and Sir Clements Markham. While special emphasis was given to the work of land expeditions, the continuation of oceanographic research as the wing that throws light upon the nature of the adjacent continent was included in the programme, and the details of the task in hand were thus formulated by Murray:

1. To determine the nature and extent of the antarctic continent.
2. To penetrate into the interior.
3. To ascertain the nature and depth of the ice cap.
4. To observe the character of the underlying rocks and the fossils.
5. To take magnetic and meteorological observations both at sea and on land.
6. To observe the temperature of the ocean at all depths.
7. To take pendulum observations.
8. To sound, trawl and dredge.

To British science belongs the glory of having proved the feasibility and comparative facility of penetrating the ice pack and actually landing parties of explorers on the antarctic continent, and practically all the land journeys in that quarter have been made by Britons, with the exception of Amundsen's. The abortive Japanese undertaking of a year ago hardly deserves mention in this connection, while Filchner's German expedition, expressly organized for the purpose of a long overland journey, appears to have accomplished little if any exploration on land, though the details of his travels just completed are still unknown.

The mere size of Antarctica ought to suggest to the practical reader a number of answers to his inevitable *cui bono?* concerning antarctic exploration in general. The continent of which Capt. Scott in his first expedition was the pioneer explorer covers some five and one half million square miles of the earth's surface—about the area of Europe and Australia combined. A gap of this extent on our maps precludes any complete knowledge of the wind systems of the globe, of the distribution of the magnetic elements, of the main structural features of the earth's crust—in short, of a host of fundamental matters the ultimate practical bearings of which ramify through our everyday life and affect the welfare of all mankind.

Before the new era in South Polar exploration which Scott inaugurated, the continental character of Antarctica was altogether conjectural. It was hardly doubted that at some time in the remote past land had extended continuously from South America to Australia, a fact explaining the remarkable points of resemblance between the existing faunas of those two regions; but all that was known

about the modern remains of this land mass could be explained as well on the assumption of an archipelago masked under a load of ice as upon that of a continent In fact up to a year ago there appeared to be strong reasons for believing that the so-called continent was cleft in twain by a broad channel connecting Ross and Weddell seas and this belief was only conclusively disproved by the combined discoveries of Scott Shackleton and Amundsen

In this place only a hasty summary need be given of the work of Scott's two expeditions which should be considered together since the second was definitely planned as a supplement to the first The first expedition entered Ross Sea which all experience up to date indicates is the most practicable gateway to the interior in January 1902 The first task accomplished was the exploration of the Barrier edge from end to end The Barrier was found to have receded some thirty miles since the days of Ross A landing was made and a captive balloon sent up for the inspection of the interior Next Scott discovered the high land bounding the Barrier to the east and named it King Edward VII Land At the other end of the Barrier he discovered that the volcanoes Erebus and Terror are on an island (Ross Island) and the volcanic formations here were thoroughly studied The great achievement of this expedition however was the exploration of the huge range of mountains extending south from Cape Adair and of the ice plateau lying west of them During the first season Scott made a sledge journey due south parallel to the Victorian range to a point nearly three hundred miles nearer the pole than any one had gone before During the second he traveled westward scaling the mountains by the Ferrar Glacier and advancing over the inland ice one hundred and sixty miles The magnetic observations made on this journey fixed the location of the magnetic pole afterward actually reached by members of Shackleton's expedition During the two years the party made splendid series of meteorological magnetic pendulum tidal and biological observations

The second expedition which sailed in the autumn of 1910 was with the possible exception of Filchner's the strongest scientific expedition that ever entered the Polar regions Shackleton a member of the first expedition had in the meantime returned to the Antarctic on his own account made further explorations from Scott's old base and pushed over the Beardmore Glacier to a new and sensational farthest south in the very heart of the continent Scott's original plan in his second enterprise was to distribute the activities of his large and able staff in four principal directions an eastern party was to explore King Edward Land a western party the Victorian range west of McMurdo Sound a party was to remain at headquarters to carry out elaborate scientific observations and a southern party headed by Scott himself was to proceed if possible to the Pole in order Sir Clements Markham would have us believe to make magnetic observations the only practical reason for going there His expedition as a whole carried out a programme of scientific research as thorough as the most conservative members of the enterprise at home could have desired Some changes in the plans had to be made The eastern party under Lieut Campbell was unable to land on King Edward Land, and proceeded instead to Cape Adair thus becoming the northern party After a year of exploration in that region they were picked up by the expedition ship the Terra Nova and set ashore again at Terra Nova Bay for a short sledge journey The ship was however unable to take them off on account of impassable ice and with very meager stores and only a summer outfit they were obliged to improvise winter quarters in a snowbank, ultimately making their way 200 miles overland to the expedition's base at Cape Evans.

The western party carried out geological work on an extensive scale, and dis-

covered, among other things, a deposit of bituminous coal, evidence that a temperate climate must have once prevailed in this region. They also found thousands of wingless insects of two species. The party at headquarters made very thorough meteorological and magnetic observations. A magnetic observatory was excavated in the side of a glacier to secure uniform temperature throughout the year. The physical work was carried out by Dr. George Simpson of the Indian Meteorological Department, who is a specialist in atmospheric electricity. Dr. Simpson returned to England last summer, and at a meeting of the Royal Meteorological Society announced some very interesting discoveries in meteorological optics made during his southern sojourn. Upper air soundings were made with balloons to a height of six miles. A bold feat carried out in midwinter by Wilson, Bowers and Garrard consisted of a five weeks' journey across the Barrier to study the incubation of the emperor penguins, which breed in winter.

The suggestion made some months ago by Mr. E. S. Balch in the Bulletin of the American Geographical Society that Scott had chosen the meteorologically worst side of the Barrier for his inland route has been tragically confirmed. The furious blizzards for which the whole periphery of the Antarctic continent is notorious, sometimes attaining a force of 70 or 80 miles an hour, appear to be the result of air draining down the slopes of the vast ice-cap of the interior. In accordance with a well known law they are deflected to the left by the rotation of the earth. Thus the furious blizzards of the Barrier are mainly from the south-east, and a glance at the map shows that Scott must have experienced the full brunt of them, to say nothing of the fact that they delayed his departure from his base to a dangerously late period in the season. Amundsen's route, and especially the location of his base, was far more favorable with respect to these winds—and a comparison between his and Scott's experiences affords a striking lesson in antarctic meteorology. However, this comparison does not indicate better judgment on the part of the Norwegian explorer, for his easterly route was chosen solely to avoid trespassing upon territory pre-empted by another.

A comparison between Scott's and Amundsen's methods of travel lies beyond the scope of the present article, but the writer may perhaps be pardoned for suggesting that Scott's preference for human as compared with other modes of traction seems the height of quixotism.

The Heavens in March

(Concluded from page [illegible].)

Taurus setting after 11 P. M. Uranus is in Capricornus, rising about 4 A. M. Neptune is in Gemini, and sets at about 3 A. M.

The Moon is new at 7 P. M. on the 7th, in her first quarter at 4 P. M. on the 15th, full at 7 A. M. on the 22d, and in her last quarter at 8 A. M. on the 29th. She is nearest us on the 21st and farthest away on the 6th. As she completes her circuit of the heavens she passes Jupiter on the 2d, Mars and Uranus on the 4th, Mercury on the 9th, Venus on the 11th, Saturn on the 13th, Neptune on the 17th, Jupiter again on the 29th, and Uranus on the 31st.

At the time of full Moon on the 22d there is a total lunar eclipse. The earlier phases of this are visible in the eastern part of the United States, and the whole eclipse on the Pacific Coast. The Moon goes almost centrally through the Earth's shadow, and totality lasts more than an hour and a half. According to Eastern standard time the first contact of the Moon with the shadow comes at 5 13 A. M., totality lasts from 6 11 to 7 44, and the Moon leaves the shadow at 8 43. Only the beginning of the eclipse can be seen from Washington, but from points on the Pacific Coast, by whose time all the phases occur three hours earlier, the whole eclipse can be observed.

Princeton University Observatory.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12753) C W B. writes In reference to query 12741 please allow me to suggest that there are no hatcheries in the clouds for breeding angle worms toads or frogs. Angle worms breed and live in the ground and they are so secure there that no wind is sufficient to suck them out and up to the clouds. But as their enemies, the birds, prey on them during the daytime, they have become night workers, and parade mostly in the night, and especially during warm rains. The worms P S F saw came out during the "several hours of rain" but a sudden change to snow stiffened them so they could not get back into their holes. They struggled for life and kept on top of the accumulating snow but at last froze to death where he found them Of course, everybody knows that toads and frogs breed in water As soon as they have developed from tadpoles, they generally change their dwelling place from water to land during a warm rain in spring and early summer Their sudden appearance at such times has developed the popular fallacy that they have rained down! Now are not these common sense explanations, and also in accordance with scientific knowledge? A There can be no doubt of the common sense character of C W B s explanation of the phenomenon in question. Nor is there any doubt that in certain storms there is an upward current sufficient to raise small articles and carry them long distances before they drop out of the whirl. Waldo s Elementary Meteorology page 248, states that large rain drops 0.1 inch in diameter require an upward current of only 16 5 miles per hour to sustain them when the air pressure is 23 inches while small rain drops require an air current of only 3 miles per hour to prevent their falling to the ground Also, In case the ascending current in a tornado had a velocity of 100 miles per hour where the pressure of the air is 16 inches, this would prevent a hail stone 2 5 inches in diameter from falling to the ground These ascending currents exist in all violent storms, and in ordinary storms to a lesser degree. Any particular instance must be determined by the circumstances of that particular instance and cannot be determined by any general belief in the possibility or impossibility of the carrying up and dropping of small things from the clouds We grant that this explanation should have been given in the former note so that the meaning might have been clear Our meaning was this Whether small worms were carried up in the particular instance must be determined by a knowledge of the force and character of the storm in question conditions which we did not know The only condition we intended to state was the possibility of such an occurrence with a sufficient rotary motion of the storm.

(12754) J C D asks Please explain in non-technical language how the Chinese use the Chinese abacus to count And why other nations do not use it. A The Chinese abacus is simply a counting board on which the results of computations done in the head are tallied as it were It is a shallow box divided lengthwise by a bar and having several wires crossing the box and passing through the bar On one side of the bar are five balls and on the other side there are two balls. The five balls stand for units, and the two balls stand for five each or ten taken together When the five balls on one wire have been tallied one of the two balls is pushed up the five balls are pushed back and the tally proceeds till another five has been tallied when one on the next wire is pushed up and this ten (or two fives) is pushed down Any wire may be taken as units. Those to the left will be tens hundreds etc those to the right of this will be tenths, hundredths, etc. Simple tallying of calculations is done on the abacus with rapidity, but if a mistake is made it cannot be detected. The work must be gone through again A similar instrument was employed in ancient times by the Romans, but modern nations find paper and pencil a better way to perform their reckoning.

(12755) H J S. writes Recognized as the only authority I seek information. Is it necessary for one to stand on *all* three rails of a third-rail system in order to get a shock? Are not the two running rails connected as one arm of a current, with the third rail as the other? Is it not possible to stand on the third rail and one of the running rails and receive a shock? Also in rain, through a short circuiting, cannot one receive a shock standing on the third rail alone? A In a third-rail system the two rails which carry the cars are in connection with the earth, and cannot give any shock by themselves. The current comes by the third rail from the power house and the third rail is charged to full voltage all the time. Standing on the ground or on one of the rails of the track, you will certainly receive a severe shock by touching the third rail. Standing on the third rail alone, no shock would be felt, since there is no way for the electricity to escape from you to the earth If you step off, you will receive a shock when you put one foot upon the ground, the other being on the third rail.

SIXTY-NINTH YEAR

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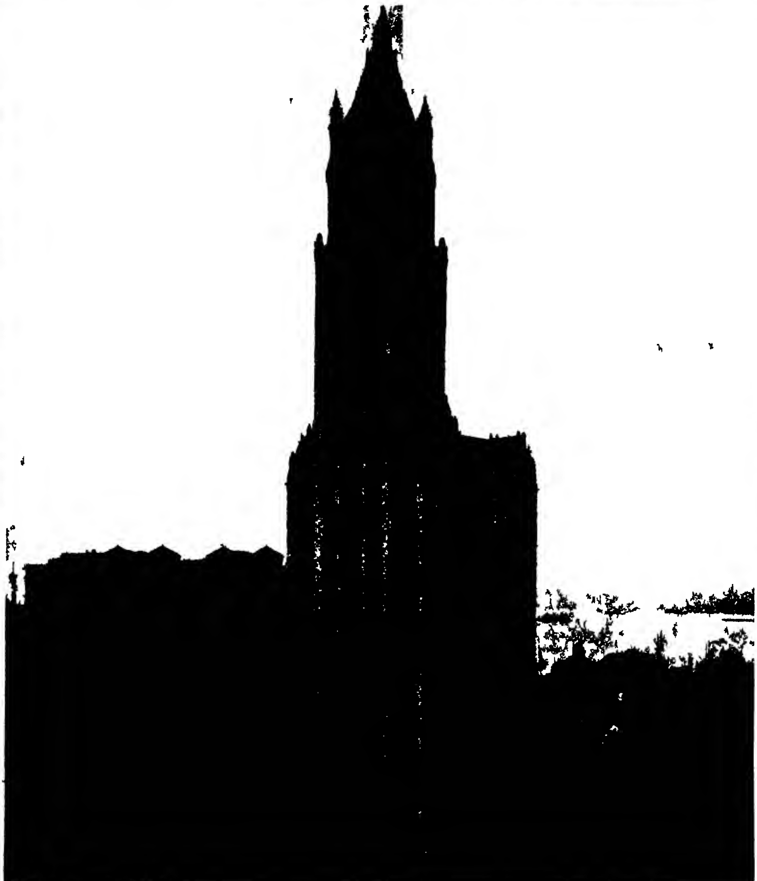

Removal of old buildings commenced, September 1910 ex a at on of site, November 1910 sinking f unds on a stone Dece n er 1910 first stee o umn e ed O 1911 steel work completed June, 1912 the above photograph taken, November 25th 1912 H ght abo street 785 feet Weight of stee 23 00 ons

THE TALLEST OFFICE BUILDING IN THE WORLD.—[See page 224.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are *sharp*, the articles *short* and the facts *authentic* the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement

The Proposed New Patent Office Building

On February 15th 1913 Mr Burnett of the House Committee on Public Buildings and Grounds reported a bill on public buildings. Section 15 of this bill authorizes the creation of a commission composed of the Secretary of the Interior the Commissioner of Patents, and the Supervising Architect of the Treasury to cause plans and estimates to be made for a building, to accommodate the United States Patent Office

The President's Commission on Economy and Efficiency in its report of the investigation of the United States Patent Office pointed out the necessity of a new structure in no uncertain terms In the case of the entire force of the office numbering 930 people says the report, it is quite evident that the best results cannot be obtained under existing conditions

The present building was completed in 1867 and the newest wing is now forty five years old While the building was probably adapted to the use to which it was put at the time of construction it is conspicuously unsuited to present needs. The report of the President's Commission points out that the amount of breathing space allowed to employees is most inadequate under the present system of ventilation and that this system cannot be improved because of the large number of persons who are compelled to work in very confined quarters The space consumed in the rooms of the examining divisions is from three to five or more times that found in most offices

The basement floor of the Patent Office is occupied in part as a storeroom Its condition is a disgrace to the Government Dirt conveyed from the streets is deposited on the floors- flag stones between which are large cracks—and accumulates in thick layers on the publications. The condition is aggravated because the sale copies of patents, of which these publications are chiefly composed are open both in front and rear so that the dirt and dust cannot be excluded Much handling of the publications (they are frequently called for) stirs up the dust, so that it seeps into the working rooms of the examiners adjoining the files.

Apart from considerations of health and efficiency, there is the risk of fire There have been two serious fires in the Patent Office in one of which all the original records were destroyed If burned or gutted the record of ownership of the patent property of the whole country would be lost causing irreparable injury to many inventors assignees, and manufacturers While the possibility of loss by fire applies to the Patent Office as a whole it is particularly applicable to the assignment records. The recorded transfers of interests under patents in the United States Patent Office are probably the only recorded evidence of the titles to millions of dollars invested in patent rights

The President's Commission as a result of its investigation recommends that an appropriation be provided for the erection of a new building to be used exclusively by the Patent Office and to be properly designed and equipped The Commission estimates that a suitable building would cost between four and five million dollars, which does not include the cost of site, nor the equipping and furnishing of the building

The House Committee on Public Buildings and Grounds has had under consideration more than seven hundred bills. The total appropriations called for by these measures is more than three hundred million dollars, while the total authorization recommended by the Committee is less than one twelfth of that amount. It is sincerely to be hoped that the Patent Office will not be ignored, and that Mr Burnett's proposals will be accepted by Congress.

Modern Argonauts of Science

An army of scientific workers all over the world is faithfully laboring, and advancing with slow and sure progress the frontier of our knowledge. Research has become systematized, and a gradual widening of our horizon assured. But no systematizing can secure for us the fruits which it is reserved for the great genius to gather The researches of men like Sir J J Thomson, Sir William Ramsay and not a few others stand on a wholly different plane, and must not be compared with the work, however expert, of the rank and file in science Such men do not follow the beaten track, where some degree of success is assured to him who has reasonable skill and sufficient perseverance They achieve that which to the average man would have appeared impossible—until it faces us, an accomplished fact

In the particle shot out by radium with a velocity of 12,000 miles per second, a Ramsay recognizes an atom of helium A Rutherford achieves the incredible task of counting the number of molecules in a measured quantity of gas. A Perrin prepares an "artificial gas" made up of a vast number of particles of nearly equal size thus mimicking the molecules, and furnishing a model which exhibits the characteristic properties of a typical gas. A J J Thomson constructs a miniature gun three inches long and having a bore one two-hundred and fiftieth of an inch, and with it shoots molecules at a muzzle velocity of some ten thousand miles per second He does this to determine their weight, which they are made to register on a photographic plate Is this a fairy story? No, it is far more wonderful than any fairy story, for it is the achievement of man in the twentieth century

What remains for to-morrow to accomplish? We dare not prophesy There are rumors of the synthesis of matter, the building up of molecules from simpler bodies, or perhaps from something which is not matter These rumors may prove unfounded What then? Has not enough been achieved? And the future surely holds a richer harvest still in store

The reader who seeks further information on these things will find it on another page of this issue and in several important articles in this week's Scientific American Supplement

Economy That May Be Disastrous

We have before us a photographic reproduction of a target after it had been fired at by a battleship which used a new system of fire control that enabled the ship to deliver the projectiles of a whole broadside at the enemy simultaneously and practically in the same spot on the ship. Instead of the separate and single shot holes obtained under the present methods of firing this target has huge well-defined gaps ten to twenty feet in diameter, which seem to indicate that a whole salvo of five or ten 13.5-inch shells passed through at those points. Under this system the whole battery is aimed and fired by one man, the errors of individual pointers being eliminated The significance of the result will be the more appreciated when it is known that the firing was not done in smooth water, but in a seaway which caused the firing ship to roll rather heavily

It is a common saying among the officers of our navy that the first salvo which lands will settle the fight—so great will be its moral and material effect. That statement however, refers not to collective, but to individual firing in which such shots of the salvo as landed would be scattered on the ship, whereas the target above referred to proves that one foreign navy, at least has developed a system by which the whole battery of ten or twelve heavy guns can be enabled to bunch its projectiles within a limited area of the enemy's ship.

Now since it will be possible by this system to land at least one such salvo (provided of course that the range were not lost) at intervals of a minute or less, it must be evident to the veriest tyro that the naval battle of the future will be decided not by hours, but by minutes.

In the contest between gun and armor, the victory to-day is decidedly with the gun Our own 14-inch guns can pierce any armor afloat at the present fighting ranges, and already 15- and 16-inch guns are under construction for some foreign navies. In spite of their exceedingly heavy armor, not even our own "Pennsylvania" and "Nevada" could withstand such an attack as was successfully delivered in the case of the target practice above referred to. One single concentrated broadside might easily disable her, and it would not take many such to send her to the bottom.

It is certain that among the leading powers there is no element of naval efficiency to which so much thought, attention and practice is given as that of good shooting. No one navy will have any monopoly of this. It is reasonable and prudent to suppose that, if our battleships ever find themselves drawn up in line against those of an enemy, the shooting of the foe will be just as good as our own. If this system of one-man control of the fire becomes general, as it must do in the course of time, it is evident that victory will belong to that fleet which is able to place the greatest number of heavy guns along the battle line. In the future battleship fight Providence will certainly be on the side of the heaviest artillery, and a preponderance in ships and guns will probably spell an early victory for the fleet that has it.

The Scientific American is to-day, as it has always been, a most earnest advocate of peaceful methods—where they are possible We are strongly in sympathy with the efforts which have been made to bring about universal arbitration At the same time we believe that one of the strongest influences making for peace, particularly in the case of this country, is the possession of a navy sufficiently strong to cope with any international emergencies which may arise. Do we possess such a fleet? We do not, and that our navy is far below the strength which it should have, and is in danger (if the present small navy policy is followed) of falling yet more below that standard, is evident from the following comparison of our strength with that of the two most powerful foreign navies (except, of course, that of Great Britain) in the two oceans.

If Congress makes appropriation for one battleship only this year the vessel may possibly be in commission by the year 1916, and if so, a comparison of our battleship and battle-cruiser strength with that of Japan and Germany shows the following results

Assuming that the battle-cruisers, as their name suggests, will be put into the battle line of a great engagement, we find that in the year 1916 Japan will be able to oppose to our ten dreadnought battleships six battleships and seven of the largest battle-cruisers, making thirteen vessels well armored and carrying the heaviest guns, and that Germany can oppose eight armored cruisers and seventeen battleships against our ten battleships Of battle-cruisers we do not possess any Now assuming that the one-man control of fire has become general by that year, and that the first five or ten minutes of an engagement will probably decide the issues of the fight, it is seen that Japan would have a superiority at the outset of 30 per cent in ships, while Germany would be in a position to oppose a first fighting line of thirteen ships to our ten, with a reserve of twelve first-class ships to relieve their first line, should it be badly punished or, what is more probable, to engage our fleet simultaneously on the other broadside

In the presence of these facts we ask On what possible theory of patriotic and far-sighted statesmanship, is the House of Representatives proceeding in its present opposition to the demands of the country for an adequate navy?

The Money Value of Street Lighting

The most prosperous, the most talked-of street in the western hemisphere is Broadway, New York Electric lighting made it so. Its millions of electric bulbs stand for business enterprise, wealth, prosperity That good street lighting means dollars and cents to a community, the city of Cleveland has demonstrated to its own satisfaction. A few years ago the north side of Euclid Avenue, between East Fifty fifth and East Sixty-sixth streets, installed a block of ornamental street fixtures. The result was magical. That side of the street was crowded, the other side, deserted. Real estate values increased on the illuminated and decreased on the dark side. Not until both sides were equally well lighted was a commercial equilibrium established on that particular section of Euclid Avenue Similarly, Minnesota Street, between Fourth and Seventh streets, in St Paul, was transformed from a gloomy thoroughfare, flanked by dilapidated structures, into a prosperous street in which new buildings took the place of the old—a result accomplished entirely by street lighting.

Three hundred cities in the United States and Canada have tried ornamental street lighting and have found that it pays as a municipal investment, as well as in heightened civic pride, in greater prestige, and, therefore, in better citizenship.

Cities, like human beings, are judged by impressions. The fleeting glimpse of a town caught from the windows of a railway train that stops for a few minutes at a station leaves an indelible impression upon the traveler If he sees nothing but forbidding gloom, punctuated by an occasional flickering gas lamp, he inevitably sets down that community as a third-rate municipality, if he catches a glimpse of a main street ablaze with light, he knows that here business thrives. Gloom means dirt, squalor, stagnation; light means activity, industry, life. From the lighting of a city its character can invariably be deduced.

Electricity

The Largest Swiss Hydro-electric Generating Station.—The hydro-electric generating station which is now being equipped at Laufenburg, on the Rhine, for completion in 1914, will be the largest plant of its kind in Switzerland. The ten turbines will have an aggregate capacity of 32,000 kilowatts, at 6,000 volts which will be stepped up to 47,000 volts for transmission. It is estimated that Swiss waters are capable of furnishing two million horse-power of which upward of one half million horse-power is now "harnessed" and in actual use.

A Novel Ice-breaker.—A high-tension wire in the spray above a dam recently became so loaded with ice as to stretch and sag until it was down almost to the water. Ice hung upon it in a sheet like an apron, thickest in the middle like a thin crescent moon. A power-house employee suggested shooting it off with small shot which could not injure the wire. Standing some distance below, so that the shot scattered widely, he broke off the ice in sections of two or three feet until the wire was entirely clean.

Further Improvement in the Steam Turbine-generator.—A distinguished British electrical engineer announces some very promising experiments in obtaining higher efficiency for the steam turbine, so increasingly employed in electric generating plants. The new method consists in re-superheating the steam after it has passed through one of the stages of the turbine and using high temperature, the latter being rendered possible by coating the steel blading with sheet nickel. A 5,000-kilowatt steam-turbine generator on this system was found to consume only 7 pounds of steam per shaft horse-power, and a still better performance is expected, namely, 6 pounds of steam per horse-power, or a thermal efficiency of 24 per cent.

Submarine Telephony Over Uninsulated Cables.—It is reported that telephoning over a bare iron submarine cable has been accomplished by the invention of an Englishman. Using ordinary telephone apparatus clear-speech transmission was obtained, and even the loud-speaking reproduction of a phonograph record, over eleven miles of this uninsulated cable. From present advices it appears that a thin layer of hydrogen on the surface of the immersed conductor, supplied electrolytically by a polarizing or "pilot" current performs the function of the usual dielectric—certainly an ideally cheap insulation. Another advantage claimed is the elimination of electrostatic capacity—a very important point where long-distance submarine telephony is concerned.

Electric Power from Coke-oven Gases.—Internal combustion engines utilizing furnace gases are increasingly employed in Europe. A large mining and metallurgical works in the north of France has decided to use the gas from 160 recently-built coke furnaces to obtain power for operating electric motors and lights about the works and in the surrounding district. Two methods of developing power from gas fuel are to be used. Burning the gas under steam boilers, which in turn supply steam-turbine generators, and piping the gas direct to internal-combustion engines. When completed the latter plant will consist of six generator units each of 12,000-kilowatts capacity. A gas holder of 15,000 cubic feet capacity will serve to tide over any temporary failure of the gas supply.

International Transmission Line.—The new power line which runs for 85 miles from the Swiss hydraulic plant of Olten-Goesgen in order to bring current to the extensive Ronchamp coal mines in east France is of interest from the fact that it crosses three countries, that is, Switzerland, Germany (Alsace) and France. It is also a good example of the modern use of current for lighting and motors in coal mines and this is in fact on the increase in Europe. The present mines are located in the coal district near Belfort and not far from the German frontier. About 6,000 horse-power in the shape of three-phase current will be brought over the pole line, using 70,000 volts. High steel towers are a noteworthy feature of the line, and the span is an unusually long one of 650 feet.

Lighting Light-Buoys by Wireless.—A German inventor Grimmeisen claims to have found a method for using wireless waves in the best manner for lighting up distant lamps, either electric or gas lamps, by the use of an accurately tuned wireless receiver at each lamp so that it is sensitive to only one wave pitch and no others. The wireless waves act upon a receiver combined with a local relay for working an electromagnetic switch so as to turn on the current or gas as the case may be. This idea is in itself not a new one, as we are already familiar with wireless-distant control devices, but the originality lies in the close tuning of the receivers so that only a given wave frequency will work them. The device will thus be a valuable one for seacoast lights, and especially for light buoys. Before this, sea cables were run from the buoys to shore to bring the current, but such cables need to be very strong so as to stand the severe strain of the waves. On the new plan, a battery can be used in the buoy, and the current be turned on by wireless.

Science

An Iceberg Patrol.—In accordance with an agreement between the British government and the North Atlantic steamship lines, the British Board of Trade is fitting out a ship to patrol the steamship routes in search of icebergs and other dangers to navigation. The vessel engaged for this purpose is the "Scotia," known to fame as the ship of the Scottish Antarctic Expedition of 1902 to 1904. She was originally a Norwegian whaler, the "Hekla."

To Explore New Guinea in an Airship.—Lieut. Graetz, the German traveler who gained fame by crossing Africa first in a motor-car and then in a motor-boat, is now trying to finance a scheme for sailing over New Guinea in an airship for the purpose of exploring the little-known interior of that island. The proposal has been well received in Germany. A similar plan for exploring New Guinea was proposed two or three years ago by Dr. Kurt Wegener, but never came to anything.

Fixing India Ink.—The composition of India ink—a mixture of ivory-black and a colloidal substance such as fish-glue causes drawings, diagrams or designs made with it to run and blur when wet or even dampened by the moisture of the air. This is a serious disadvantage in many cases, especially for industrial purposes. *Les Annales* suggests a remedy which makes the ink practically indelible. This is to brush the design when made with a solution of 20 grammes of potassium bichromate and 20 grammes of bichromate of ammonia in 100 grammes of water.

An International Phytogeographical Excursion Across the United States—evidently inspired by the great success of transcontinental geographic tour of last summer—is now being organized, a preliminary announcement on the subject having been issued by Prof. H. C. Cowles of the University of Chicago, and Prof. F. E. Clements of the University of Minnesota. The excursion is to begin at Chicago about August 1st, and close at New York about October 5th, 1913. Well-known typical forms of vegetation will be inspected along the route, and several universities and other institutions of botanical interest will be visited.

The New French Chronology.—The use of the new 24-hour time system in France is likely to give rise to some rather curious results. One of these is brought out by A. De Mortillet and relates to the striking of the hour. It will not be very practical to use 24 strokes or less in succession as these would be very difficult to count after a certain point. The number of strokes should therefore be reduced in some way. He proposes using a double chime, one bell for units and the second for tens, the two bells to have a different tone. Or else with a single bell rapid strokes would show the tens, and slow strokes the units. With two bells, one bell gives strokes up to 9. The second bell rings once for 10. For 11, the first bell rings once and the second once, and so on in the decimal system. For 20, the first bell rings twice, and so on.

Tellier at Last Recognized.—At the age of eighty-five years and living almost in penury Charles Tellier the inventor of the system of cold storage now used all over the world was decorated recently with the cross of the Legion of Honor, and banqueted by the International Cold Storage Association. A subscription of \$15,000 was raised for him, so that the remaining years of his life may be passed in comfort. Like many another inventor before him he sacrificed everything in carrying out a brilliant idea. As early as 1876 he built the ship La Frigorifique" which took a cargo of frozen meat from Rouen to La Plata, the first consignment of what has since become an industry of world-wide trade. Fittingly enough the banquet given in Tellier's honor was composed exclusively of products from distant countries the transport of which was made possible by the method suggested over a generation ago by Tellier.

The Tsangpo-Brahmaputra Question.—At this late date, when cartographers have generally ceased to indicate their doubts about the identity of the Tsangpo and the Brahmaputra rivers by the use of a dotted line in the unexplored section, it is rather disconcerting to have the old question raised at a meeting of the Royal Geographical Society, as happened a few weeks ago. In discussing a report by Mr. Bentinck on the geographical results of the Abor expedition, Capt. L. A. Bethell, who spent some time near the Tsangpo during the Lhasa expedition and who has recently been stationed along the Dihong (the supposed connecting link between the Tsangpo and the Brahmaputra), expressed his belief that the Dihong has not the volume of water that it ought to have if it were continuous with the Tsangpo. He observed moreover, that the Dihong was extremely sensitive to local conditions of rainfall, and behaved exactly as it would if entirely dependent for its water on a local catchment basin. Fortunately there is a British expedition working along the Dihong this winter, and if it is merely a local stream this fact will probably be ascertained. But, if so, where is the outlet of the Tsangpo, the greatest river of Tibet? It is truly exasperating that explorers are not able to traverse some fifty or sixty miles of debatable ground on the Tibetan frontier and settle once for all one of the most interesting of geographical problems.

Aeronautics

An Aeroplane Boat.—Shakir S. Jerwan and Fuad S. Jerwan of New York city have patented, No. 1,049,865, an aeromotor boat which has an aeroplane with wing frames and a tail frame from which means are supported to float upon the surface of a body of water to buoy up the aeroplane and comprising air tanks supported beneath the wing frames and the tail frame to prevent them from dipping into the water.

A Wright Patent Decision in America.—On the 27th ult. by a decision handed down by Judge Hazel of the United States District Court, the Herring-Curtiss Company and Glenn H. Curtiss individually, are held to infringe the Wright patent. While the Curtiss machine differs in form from the Wright the court held the use of ailerons and a vertical rudder was the same in principle as warping wings and said rudder especially since Curtiss often uses the rudder to help right the aeroplane when it tips. The text of the decision will be published in the SCIENTIFIC AMERICAN.

Wright Patents Upheld in Germany.—A judgment rendered in the Supreme Court of the German Empire on the 26th of February appears to have upheld the Wright patent. By this decision the invalidating of the basic feature of the Wright patent—the warping of the wings in conjunction with the movement of the vertical rudder—by the German Patent Office, does not stand. The only reason the court did not allow the warping of the wings alone was on account of the publication of this principle by the Wrights and Chanute prior to the application for letters patent.

A Record Flight from Paris to London.—On the 25th ult. a new record of 1 hours and 5 minutes was made for the 300-mile flight from Paris to London by the French aviator M. G. Brindejonc des Moulinais. Starting from Paris at 9.15 A. M. a descent was made at Calais 1 hour and 35 minutes later. The flight across the channel was made in a fog and the aviator finally reached the outskirts of London at 1.30 P. M. An average speed of over 90 miles per hour seems to have been attained by the high-powered Morane-Saulnier monoplane.

A Safety Harness for Aviators.—In order to harness an aviator to the machine and at the same time permit him to readily release himself when desired, Willard Irving Twombly of New York city has secured a patent, No. 1,050,874, for a safety harness in which a series of straps are connected together at one end and to the framework of an aeroplane and extend over the shoulders and around the body of the aviator and means are provided for assembling all of the free ends of the straps in front of the aviator, so that he can simultaneously release them, when desired.

A Successful Trans-Alpine Flight.—For the second time a monoplane has flown across the Alps from Brigue to Domodossola. Jean Bielovucic, a young fellow countryman of Chavez, whose first flight across on September 25th, 1910, terminated fatally in the second to accomplish this feat, and to make the flight in mid-winter at that. Besides paper clothes, he wore three thick jackets and woolen gloves. His machine was a Hanriot monoplane. The start was made from a plateau near Brigue from which the snow had been cleared, at noon on January 25th. The weather was fine there being little or no wind. In a few minutes the machine had risen to a height of 7,500 feet and it disappeared from view. Profiting by Chavez's experience Bielovucic flew over the Monteera Pass where the air-whirls and gusts are not so dangerous as over the Simplon. In 28 minutes he was above Domodossola where he volplaned safely to earth. He reached an elevation of 2,800 meters (9,180 feet) during the flight. His chief sensation was a feeling of loneliness when high above the Pass. Upon alighting he was rather light-headed and numb with the cold.

Latest Requirements for Army Aeroplanes.—Specifications which have lately been issued for army aeroplanes are not nearly as rigid and difficult of fulfilment as they doubtless would be if the aeronautic industry in America had kept pace with that abroad. The new machines must be capable of a speed of from 38 to 55 miles per hour. They must carry two persons and a radio-telegraph set weighing about 75 pounds. They must ascend 2,000 feet in 10 minutes when carrying a live load of 450 pounds, and must make a continuous flight of 4 hours duration during the first part of which a flight of 180 miles across country must be included. All new army aeroplanes must be capable of arising from or alighting upon a harrowed field or a field covered with long grass in not over 100 yards. They must describe figure 8s within a rectangle 500 yards by 200 yards without losing more than 100 feet in altitude. The aviator may make this test alone. A higher rating will be given machines provided with an efficient stabilizing device, a motor that can be started from within the body and a motor having an effective muffler with cut-out, also a flight in a 20-mile wind will add to the rating. All machines must have bodies protected with chrome sheet steel 0.075 inch thick.

Salt-rising Bread

Raising Dough With Newly Discovered Bacteria

By H A Kohman, Senior Fellow of Bread Research, University of Pittsburgh

[THE author holds a fellowship granted by the National Association of Master Bakers for Research on the Chemistry of Bread, under the direction of Prof Robert Kennedy Duncan EDITOR.]

The history of bread extends over incalculable time, and its origin is quite obscured in the mists of antiquity The words 'bread and leaven' receive mention in Genesis and Exodus and other books of the Old Testament indicating that baking as an art was practised in remote ages The early discovery of the leaven process was without a doubt purely accidental and may be traced to the fact that in eastern countries a mixture of meal and water if forgotten for a day will ferment This simple way of inciting fermentation together with the advantages of light bread soon led to the adoption of the leaven process

Although leaven was used even in ancient times, bread making methods remained crude and uncertain and the nature of fermentation was not understood until recent years. It was the classic work of Pasteur in 1857 that proved beyond any reasonable doubt, that alcoholic fermentation, such as occurs in ordinary bread owes its origin to one-celled, microscopic plants (yeasts) As the result of this research and others, the manufacture of yeast has become a science and the old time leaven has been replaced by the almost perfect product now available Naturally the progress in yeast making was followed by revolutions in baking Yeast has proved to be literally the life of the baking business, and has made it one of the world's great industries

While the method of preparing bread with yeast has been extensively investigated and the function of this micro-organism in bread is thoroughly understood salt rising bread has been peculiarly neglected If we search the literature upon bread, we shall find volumes upon its preparation by means of yeast—and a mere smattering upon salt rising methods. Yeast bread is made upon scientific principles but the methods for the salt rising type are as crude and uncertain as they were centuries ago' The housewife and the baker still rely upon the old fashioned 'emptins' and to them it is a matter of speculation why these so often fail to rise. Yet with many people salt rising bread is the favorite bread Ex Governor Stubbs of Kansas is intensely fond of it and praises its strength giving powers. He is so fond of this bread that he induced his daughter to learn to make it by promising her a valuable prize should success crown her efforts. At first she met with frequent failures, and at times was compelled to throw a batch out to the chickens.

There is no consensus of opinion in the literature upon salt rising bread Most of the writers maintain that the gas formation which aerates this bread owes its origin to wild yeasts that accidentally get into the batch from the air or ingredients used Necessarily then it is a matter of chance as to whether the bread will or will not rise, and, indeed failures are not uncommon Some writers speak of a spontaneous fermentation and ferments, but do not specify what the germs are.

With the view of putting the preparation of salt rising bread upon a scientific basis, a thorough investigation was undertaken in the Department of Industrial Research in the University of Kansas, and completed in a similar department in the University of Pittsburgh In this investigation surprisingly interesting results were obtained A microscopic study of the 'emptins' revealed the fact that it is not yeast at all, as has been maintained but certain bacteria that raise this bread From the teeming flora of bacteria that occur in salt rising dough it was possible, with extreme difficulty and after many failures, to isolate a bacillus, which by itself can be used in making salt rising bread Not only was this bacillus tried in the laboratory, but in the home and bakery as well. A number of housewives used it with continued success, and in a modern, up-to-date bakery, where failures had been frequent, a month's trial gave perfect uniformity of bread from day to day As the discovery of yeast by Pasteur led to revolutions in the manufacture of yeast and bread making, it does not seem unlikely that the discovery of this bacillus, which is an exact parallel, will revolutionize the manufacture of salt rising bread

Studying the chemistry of bread at the University of Pittsburgh.

Section of salt-rising bread.

A double loaf of salt-rising bread.

The bread research laboratory at the University of Kansas.

The idea of making bread with bacteria need seem neither dangerous nor distasteful A bacillus may be more dangerous than a bullet," but not necessarily so. There are good ones and bad ones. Each species is specific in its action. They cause our most dreaded diseases, it is true, but they also make our vinegar, ripen our cheese, flavor our butter and tobacco, and hence no objection can be made to their raising our bread How does this bacillus differ from yeast? Each consists of small, microscopic cells that must be magnified many times to be visible. Yeast cells are oval shaped bodies, while the salt rising bacillus is rod shaped The cells of either are independent plants capable of life and reproduction. Yeast multiplies by a process of budding, while the bacilli reproduce by a division of cells known as fission " hence the many fission fungi. Reproduction proceeds with surprising rapidity, a cell dividing about every eighteen minutes. From this geometric ratio it has been carefully calculated that if there were sufficient culture media, and growth were not curtailed by prohibitive by products, the progeny of a single cell would, within a week, literally fill the oceans.

Chemically, this bacillus is easily distinguished from yeast. Yeast, as every one knows, decomposes sugar into carbon dioxide and alcohol, the former of which owing to its gaseous nature, aerates the bread Curiously enough, the same chemical changes that aerate bread take place in the production of all alcoholic liquors. The salt rising bacillus produces no alcohol, and the gas, instead of consisting totally of carbon dioxide, is two thirds hydrogen and one third carbon dioxide Hydrogen is a very light, combustible gas, and in equal quantities will aerate twenty-two times as much bread as carbon dioxide Owing to its rarity, hydrogen possesses great buoyancy, in consequence of which it is used in filling balloons and dirigibles. It must not be inferred, however, that the lightness of the gas makes proportionally lighter bread As a matter of fact salt rising bread is distinctly solid and close grained, resembling more nearly home-made bread than bakers bread.

The low density of the gases produced by the salt rising bacillus, coupled with the fact that no alcohol is produced, has an interesting economic significance Scientific research has demonstrated beyond doubt that during the normal fermentation and baking of bread, appreciable losses occur These losses, which have been estimated to approximate four or five per cent of the total nutrient value of the bread owe their origin largely to the production of alcohol and carbon dioxide, both of which, on account of their volatility, are lost In salt rising bread, these losses are less than one per cent In consequence of this difference, salt rising bread is richer and sweeter than yeast bread, for the formation of alcohol and carbon dioxide signify consumption of sugar This difference of three or four per cent in the bread yield seems a trifling matter when calculated on a bag of flour, but in the aggregate it sums up to a surprising consideration. Calculated on the Kansas wheat crop, for example, the possible saving is sufficient to cover the maintenance of both the university and the agricultural college.

The microbic flora in salt rising bread may vary greatly Frequently *Bacillus coli communis* occurs in great numbers in the mass of fermenting dough. This organism, as you know, because of its association with typhoid and other disease germs, renders water unfit for use. Yet the occurrence of this bacillus in bread is no cause for alarm, for it perishes in the oven. Furthermore, there is a sure way to prevent its ever occurring Whenever the liquid used in setting the "emptins" is brought to a boil, *Bacillus coli communis* will never appear, for it does not form spores and hence perishes in boiling water The salt rising bacillus discovered through these experiments, on the other hand, because of its sporulation, withstands this treatment. In the bread, however, even this bacillus, being in the sensitive vegetative state, always perishes in the oven. Hence, salt-rising bread is as sterile as bread made with yeast.

Why eat salt-rising bread? This is a perfectly nat-

(Concluded on page 2??)

A New Method of Educating Deaf Mutes

By Jacques Boyer

DR. MARAGE, celebrated for his many researches on the vocal and auditory organs, describes, in a communication presented to the Paris Academy of Sciences on January 13th, 1913, the principles of a new method of educating deaf mutes. Several years ago,[1] Dr. Marage showed how the auditory faculty of deaf mutes and other deaf persons can be educated with the aid of a novel siren of his invention. In nearly every case he succeeded in causing the pupil to hear very simple vibrations, as a child learns the letters of the alphabet before he attempts to analyse words and phrases.

But the vibrations employed to reproduce the vowel sounds *OU*, *O*, *A*, *E*, *I* (those of the English words *boot*, *on*, *ah*, *get*, *feet*) although differing in duration, pitch and intensity, were alike in form, quality or *timbre*. The pupil, having caught a vowel sound produced by the siren under a certain pressure endeavored to repeat that sound.

Dr. Marage has undertaken to complete his method by an appropriate training of the enfeebled auditory faculty in the perception of the more complex vibrations of speech. These vibrations (apart from the consonants, or supra-laryngeal noises, which begin and terminate the vowels) consist of the vowel sounds modified by superposed vibrations, which represent the *timbre* of the individual voice and the defects in pronunciation.

In order to obtain the variation of *timbre* required for the application of his method of progressive education of the ear, Dr. Marage causes the notes emitted by the siren, before they reach the pupil's ear, to traverse one of a series of buccal resonators, which are casts of the human mouth in the positions which it assumes in pronouncing the various vowels. The *timbre* of the note produced by the siren thus modified varies with the pitch.

These variations can be traced in the records of vibrations which are shown in connection with the accompanying photograph of the siren. The first record (on the left) was made by vowel *A* emitted by the siren without the resonator. The pitch was gradually lowered from beginning to end of the emission (from top to bottom of the record), but the vibrations preserve their original form, although they increase in intensity.

The second record was made with the same siren, emitting the vowel *A* with gradually lowered pitch, but the buccal resonator corresponding to the vowel *O* was interposed in the path of the sound. The trace of the vibrations varies continually in form and becomes more complex as the pitch is lowered.

The third record, made in the same way with the *OU* resonator attached to the *A* siren shows still greater variations. In each case the sound heard is the vowel *A* more or less modified, as if it were uttered by a poor speaker. With this apparatus and the various buccal resonators, therefore, it is possible to vary at will the four essential characters of the sound: pitch, duration, intensity and quality or *timbre*.

According to Dr. Marage, the auditory education of deaf mutes or the re-education of persons who have become deaf, requires the employment of aerial vibrations, such as those which the siren produces, in preference to the vibrations of metal rods or other instruments. The vibrations, furthermore, should be well known through preliminary photographic registration. The training should commence with very simple vibrations of constant *timbre*, representing the fundamental tones of the vowels, and should extend gradually to the more complex vibrations of variable *timbre* which occur in natural speech, the intensity of the sounds being varied from week to week in order to test the improvement in acuteness of hearing. In this way the auditory centers are awakened and the pupil gradually becomes able to understand ordinary conversation.

[1] See SCIENTIFIC AMERICAN, May 11th, 1907.

Teaching a deaf mute to hear and distinguish complex vocal sounds.

Dr. Marage's vowel siren and buccal resonators.

The Langley Medals for Eiffel and Curtiss.—Gustave Eiffel and Glen H. Curtiss have been awarded Langley Medals by the Smithsonian Institution, the first for his valuable aerodynamic experiments, the second for his development of the hydro-aeroplane.

Emerging from behind another vehicle, the driver can observe vehicles coming from the opposite direction and avoid possible collision.

Left Side Steer and Center Control in Motor Cars

By Howard Greene

WHEN automobiles first rolled on their uncertain and spasmodic ways over the roads that for so long had been sacred to the horse, they were built after a fashion that gave them every right to the appellation "horseless carriages." In truth they were nothing else, for the simple reason that, modeled after the only type of vehicle that was available as a pattern, they perforce embodied about as many of the characteristics of the horse vehicle as were not absolutely unnecessary in mechanical locomotion. What could be more natural, among other things, than that the driver should sit on the right hand side of the machine, just as the driver always had sat on the right hand side of the carriage? It was a thing accepted without question and probably without thought—so much as a matter of course that only within the last few years has there been anything like a general appreciation of the fact that there are very good reasons why the chauffeur should steer from the left side of the car. Now, however, there are many cars in which left hand steer and center control are standard, and the tendency toward this arrangement of control is becoming unmistakably stronger.

There are disadvantages in right side steering that are of considerably more importance than might appear to be the case on first thought. When, for example, a car draws up to a curb in the way prescribed by law—that is, with the right hand side of the car next to the sidewalk—a passenger sitting to the left of the chauffeur must get out into the road and walk around the machine in order to reach the sidewalk. In nine cases out of ten he cannot get out on the right hand side because he cannot pass the chauffeur and the steering wheel, and the chauffeur cannot pass the control levers. If the road is muddy or dusty the short walk around the car may be a very unpleasant one and, moreover, there is a certain element of danger from passing vehicles, to say nothing of the possibility of being splashed with mud or enveloped in dust from their wheels. The chauffeur is no better off in this respect than the passenger in the front seat, for except in the few cases where he can wriggle out between the levers he must ask the passenger to get out of his way or else climb over him. On the road with the car in rapid motion there is a phase of the right side steering situation that is more serious in that it involves more than mere discomfort. In meeting other vehicles, often also moving rapidly, it not infrequently happens that there is very little room to spare. The car may be in a street crowded with vehicular traffic or on a narrow country road where there is little opportunity to turn out. The chauffeur sits on the right, however, where he is in the worst possible position to see just how many inches there are between the wheels of his car and those of the other vehicle. Obviously an error of judgment is much more easily made where the chauffeur cannot see than where he can, and there is the possibility that both drivers may err.

It is argued in favor of right side steering that it is easy for the chauffeur to see just what he is doing when pulling up to a curb, and also that the right side position is the best when overtaking other vehicles on the road—all of which is more or less true. The ready rejoinder is, however, that experience has shown that there is little or no difficulty in making a good approach to a curb steering from the left side after a little practice, especially as the curb is stationary and there is no particular necessity for speed. And when overtaking other vehicles on the road no wise driver will speed up his car if there is so little room to spare that great accuracy of judgment is necessitated; usually the conditions are such that the overtaking car can choose the time for getting by, and so avoid complications. And in any case judging distance on the right

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The gun being sighted at small elevation.

Guns for Submarines

A Weapon That Swings Below Decks During Submergence

By Dr. Alfred Gradenwitz

Submarine gun at high-angle fire practice.

PRESENT tendencies in the construction of submarine boats are mainly toward an increase of their displacement Moreover in addition to the torpedoes carried in such boats, it is now thought advisable to equip them with defensive and protective ordnance

In accordance with the special purposes of submarine boats, Messrs Krupp have in this connection developed some special types of ordnance In order to reduce as far as possible the water resistance in traveling below the surface tapering-carriage guns of non rusting, nickel steel were chosen in the case of small calibers As regards, on the other hand medium caliber guns, which on account of their size, would oppose a considerable resistance to the water thus reducing materially the speed of traveling means had to be provided for the ordnance to be stowed away during protracted voyages below the surface These guns are designed for being got into fighting order with a few manipulations and in a minimum of time, after emerging from the water A condition to be complied with in both cases then was to make any sensitive or disturbing parts (breech sights, shoulder rests etc) readily attachable and removable

We present views of a gun of 7 5 centimeters caliber which comprises a pivoting carriage calculated to reduce the water resistance during submarine traveling It is 800 kilogrammes in weight and while out of use rests in a hold below the upper deck This hold is locked by a cover and when closed is only recognized from the slight projection of the stationary pivoting support which does not oppose to the water any resistance worth speaking of

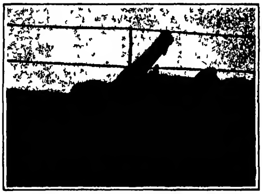
In erecting the gun and turning it down the socket rotates round a bearing situated close to the front edge of the stationary socket. In order to erect the gun the cover is opened and a bolt is loosened, after which the gun under the action of spiral springs, goes automatically into firing position It is maintained in this position by resilient bolts. Twenty seconds are required to get the gun into fighting order and to attach the breech sight and shoulder rest and the same time is occupied in removing these parts and stowing the gun away below deck

The tube of this gun is fitted with a ram lock and is made of non rusting nickel steel so that it may be stowed away in a compartment which is not water tight The cradle surrounds the cylindrical part of the tube and rests with its two horizontal trunnions in the bearings of the support On the cradle is arranged the braking cylinder with the spring for restoring the tube into firing position As seen from our pictures, the tube before being turned down is pointed vertically upward, being maintained in this position by a spring For this reason and in order to make the gun suitable for balloon and aeroplane defence, the upper part of the cradle support has been given a form allowing of considerable elevations. It may be said in this connection, that aeroplanes have already proved the most dangerous foes of submarine boats, it having been possible to sight from an aeroplane submarine boats traveling at considerable depths.

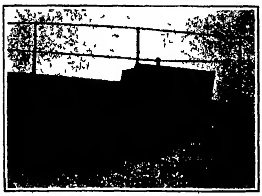
The pivoting socket has been given the shape of a column and carries at the top the bearing of the pivot It is widened out in its lower part, so as to form a case for receiving the hinge and resilient bolts. The shoulder serves to point the gun in the case of small elevations i e when used against the enemy's submarine boats, etc In firing at considerable elevations, e g., against aeroplanes the shoulder is turned round through an angle of 180 degrees The breech sight comprises a panorama angle telescope with universally rotating objective prism head. The eye-glass is not moved in taking aim

Firing is effected by means of a lever placed on the holder of the shoulder which is seized by the sighter with the left hand, while his right hand takes hold of the shoulder handle and his right shoulder is leaned against the cushion Three men are provided for operating this gun

Gun lowered, hatch closed



Bringing gun into firing position.



Gun lowered, hold about to be closed by shutters.

News From Mawson's Antarctic Expedition

THE Australasian Antarctic Expedition, under Dr Douglas Mawson, sailed from Hobart, Tasmania, in the ship "Aurora," December 2nd, 1911, for the purpose of exploring the great stretch of the Antarctic coast south of Australia, now usually known as Wilkes Land, extending from Victoria Land (the theater of Scott's and Shackleton's explorations) on the east, to Kaiser Wilhelm II Land (discovered by the "Gauss" expedition, in 1902) on the west This coast includes several minor "lands," sighted and named by various earlier expeditions, such as Adelie Land, named by Dumont d'Urville in honor of his wife, and the ever-problematical Termination Land, reported by the American expedition under Wilkes. The existence of Termination has been a subject of tedious discussion for a great many years. The matter may be disposed of by saying that there is no such land in the place assigned to it by Wilkes, but assuming the possibility that that officer made a rather gross error in his observations of latitude and longitude, excusable on the ground of weather conditions, he may have actually sighted the coast on which Wild's detachment of the Mawson party recently landed.

Mawson's expedition disclaimed any intention of pole-hunting. The party consisted mainly of graduates of the Australasian universities, and was generously financed and equipped. Dr Mawson himself is a well known geologist and magnetician, and had previous antarctic experience with Shackleton, when he was one of the three explorers who planted the Union Jack on the south magnetic pole. A radio-telegraphic station was established at Macquarie Island, and another in Adelie Land, where Mawson and a part of the expedition effected a landing in January, 1912. By means of these two stations it was hoped that messages could be relayed regularly between the Antarctic base of the expedition and the outside world, but only very recently have any wireless messages been received. After landing Mawson the ship cruised westward along the coast, and landed a second party, under Wild, at a point 1,200 miles from Mawson's station in February, 1912. The "Aurora" then returned to Hobart (about a year ago), bringing back the first detailed news of the progress of the expedition

The ship proceeded again to Antarctica last autumn for the purpose of bringing back the two land parties. Wireless messages have now come through—apparently from Adelie Land—stating that Mawson and six of his companions were unable to join the ship, evidently owing to unfavorable ice conditions, and will be forced to spend another winter (i. e., the summer of our hemisphere) in the Antarctic. A message from Mawson himself says

"Our sledging season has been very successful. We have opened up a large area of new land both east and west of Commonwealth Bay" (where his party landed) We have obtained important new data from numbers of stations in close proximity to the magnetic pole." The message also requests the royal assent to naming this new land King George V Land.

The expedition has unfortunately sustained the loss of two valuable members, viz., Lieut. B. E. S. Ninnis of the Royal Fusiliers, who was killed by falling into a crevasse nearly a year ago, and Dr Xavier Mertz, a Swiss scientist and champion ski runner

The Current Supplement

MR. F L. O WADSWORTH presents in this week's issue of the SUPPLEMENT the first part of the Preliminary Report made by the chairman of the Professional Committee to the Inventors' Guild.—Prof Bjerknes's inaugural address at the University of Leipsig, dealing with "Meteorology as an Exact Science," is reproduced in abstract.—Dr David H Ray discusses "The Skyscraper of the Future."—Mr James H. Wise describes an extensive hydro-electric power project in California.—A crude-oil Diesel engine of the horizontal type is illustrated and described.—Our readers with aeronautic interests will find an article on the Benoist flying boat, and a list of specifications of the requirements made by the U S. Government for scout type military aeroplanes.—Of the highest interest is the report of a remarkable meeting of the London Chemical Society, at which papers were read by Sir William Ramsay, Prof. Collie, and Mr Patterson, on an apparent case of the synthesis of matter This is further discussed in a special article by Sir J J Thomson, who, as our readers know, has for some time past been working with a highly ingenious and refined method of analyzing gases. On another page we reproduce his latest report on his work.—E. Marsden tells us how individual atoms are made visible and counted.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Substitute for the Compass in Fog or Snow Storm

To the Editor of the SCIENTIFIC AMERICAN

As the result of a forced descent without compass from the observatory on Mount Rose (elevation 10,800 feet) in the heavy snowstorm of January 14th to 17th, the writer offers the following suggestion to persons who know the direction in which to start, but because of fog or blinding snowstorm cannot maintain the course with sufficient accuracy to reach their destination. However, two persons are essential to the carrying out of the plan, and snow is preferable to rocks or soil, because in the former any deviation is more noticeable.

Place the members of the party in a line forming the direction in which it is wished to go and sufficiently far apart, so that the man in the rear can observe enough of the trail made by the leader to determine whether it deviates from a straight line. If any deviation occurs, the suggestion "Right" or "Left" and "Steady" to the leader will be sufficient to bring him back to the course.

J. E. CHURCH, JR.

Mount Rose Observatory, University of Nevada, Reno, Nevada.

The Timing of Motor-boat Races

To the Editor of the SCIENTIFIC AMERICAN

I have been investigating the matter of timing motor-boat races, and have talked with several different persons who, in my opinion, know as much about the subject as anyone, but I have not been able to get many new ideas.

They generally agree on the plan of having some electrical communication between the mile posts at the start and the finish, and the preference seems to be for a telephone communication, because it permits of talking back and forth between the timers, enabling them to check their watches. They can also advise each other that such and such a boat is coming, get ready for timing, etc. I do not see much chance for improvement over this system, provided they have the installation.

If such telephone communications are not to be had, then it appears to me that signaling by flags is the most reliable, as any discrepancy in timing by this method need not vary more than one fifth of a second. This is not likely to be of such serious consequence, except where an error of one fifth of a second might throw an important prize to one competitive boat when it really belongs to another. Even with the telephone system there is always a chance of this much error, and favoritism on the part of the unscrupulous judges.

It is not an easy matter to time a boat accurately that is moving at a speed around fifty miles an hour, and the chances are that the boat would be a few feet either one side of the line or the other in taking the time. I like the idea of verifying the time by a photograph at the instant the time is taken, but this requires the perfection of apparatus which probably would not be considered, and for that reason it is likely to be a useless suggestion.

In England, at the Isle of Wight, the Admiralty have a half-knot course for testing their boats. One course is up the river, and the other is in front of Osborne, in open water. Where facilities are not good for the laying out of the mile or knot course, I think it would be much more practical to have the half-knot course. In Chicago, for example, such a course can be laid out on the Government breakwater, which runs in a straight line for more than a half mile, and the marks can be set up so that the boats can be run either outside or inside the breakwater, as desired. The advantage of the half-knot course is that flag signals would be very reliable.

In all cases fixed posts, and not floating buoys, should be used, and I believe that it would be a good idea if the man who calls time, or the man who sights the posts, had his vision of the approaching boat barred by a barrier of canvas or plank, so that he could not see the boat until it actually finished at the line.

A still more practical scheme would be a funnel-shaped apparatus of say ten feet in length, this apparatus being mounted rigidly on the line, so that the timer could look through it and sight the boat by two vertical lines or wires in the telescope-like funnel. All vision of the course and the strong outside light would be cut off from the timer's eyes by means of a curtain such as a photographer uses in adjusting his instrument. The object of this funnel-shaped apparatus would be to give the timer a limited field of vision, and the tendency would be to concentrate his mind and thoughts on the correct timing of the boat as it passed the line.

Racing boats can be steered as accurately as an automobile; and as races are usually held on water shallow enough to set up posts, boats might be made to pass close enough to a post to break an electrical connection (for example, a string stretched across the course a few feet above the water, so that it would be struck by a short mast, the string not being more than thirty feet long) otherwise it would be interfered with by the wind, and the length would be so great that the time would be less correct. In this case the breaking of the string would operate electrical timing apparatus, and there would be no chance for errors of judgment or questions of favoritism.

Aside from the methods and systems used in timing boats, the first important consideration is that the timing be done by some recognized authority, otherwise it will not have the value that it should have. Personally, I favor letting the American Power Boat Association have charge of all official timing of speed boats, and I believe that the sooner the motor-boat clubs of the United States and the people interested in the sport *recognize some representative association and* TAKE AN ACTIVE MANAGEMENT IN THE SAME, the sooner will we begin to make substantial progress, and motor-boat racing will not be the fiasco that it has been in the past.

The American Power Boat Association has recently adopted some restricted class racing rules which I think will prove very advantageous to the sport. These rules are along the lines that I have been advocating and writing about for the past two years, viz., the establishing of class based on maximum cylinder volume, as has been found practical in automobile racing, and also in boat racing abroad.

The feature that I wish particularly to emphasize is that no timing system is worth considering, or of much value, if the timing is not done by officials of some organized association.

W. H. FAUBER.

New York city.

To Upbuild the Merchant Marine

To the Editor of the SCIENTIFIC AMERICAN

In your editorial in the issue of January 9th you indorse the upbuilding of the American merchant marine in the deep-sea foreign trade by a return to the system that was in effect in the early days of the republic, i. e., the refunding of part of the duties to importers bringing their goods to the United States in American-built tonnage operated under the American flag.

This is only subsidy indirect, and like all indirect measures, the benefits would not equal the disturbance, neither does it appeal to the American mind of to-day to seek to do indirectly what is not allowed to be done openly.

One factor to be specially borne in mind in the application of differential duties in favor of American importers using American-built tonnage is that every commercial treaty now in effect between the United States and foreign countries would have to be abrogated ere differential duties could be put in effect.

That means a severe disturbance of business, and the way also is open to chicanery and fraud and litigation, and this without taking into account that no mention is made of any benefit accruing to shippers generally.

It is not to be disputed that large concerns importing goods in cargo lots would find benefit by the duty differential system, but to the rank and file of importers there would be no resultant good, in fact, it is a question if they would not find themselves at greater disadvantage as far as ocean rates go by the differential system than they are to-day.

In the many theories advanced for upbuilding the American merchant marine, particular stress is laid on the benefits that shipyards and shipowners and labor employed in shipbuilding will enjoy. But shippers do not appear to be taken into account. There has been no mention in these various schemes where the American shipper will benefit in the way of reduced rates and better service. The argument is steadily advanced by the advocates of subsidy and differential duties that by these means the difference in the cost of American shipping and American operation of tonnage will be overcome, but nothing is said of lower rates. If all the American public is to get out of the change is to pay the same rate of freight and pay an additional tax to the support of American tonnage in the foreign trade it is worse off in the last analysis than before.

We have one example of indirect aid to shipping now that would seem to be sufficient for the present—the free-toll bill to American tonnage engaged in domestic port trade between the Atlantic and Pacific. Free tolls to American coastwise tonnage is nothing but an indirect subsidy, and there is not the slightest testimony that free tolls will reduce freight rates one iota, nor is there evidence that it will stimulate the building of one additional vessel that would not otherwise be built.

On the contrary, this short-sighted measure has been denounced in every section of the country, not alone because it is contended that it violates the Hay-Pauncefote Treaty, but because it is an indirect contribution to an industry already protected as few American industries are, and from which no resultant benefits flow to the body of the American people.

One of the things that hold back the development of the American merchant marine is the crew regulations. A steamer of the United States has to carry several more men than does a foreign steamer, and it is not clearly shown what the benefit is. The American merchant marine is no freer from disaster than, we will say, the British merchant marine, and yet the crew requirements on an American steamer are much more onerous than on the British. Why the management of an American steamer is compelled by law to employ only Americans while the men that may be employed to build American steamers may be of any and every nationality is one of those things that is past finding out. Whatever the reason is the facts are there, and they add to the handicap that the American merchant marine suffers from.

And yet there is a ray of hope. The difference in the cost of building abroad in foreign shipyards is steadily lessening. To-day it costs to build in a British yard about \$40 per ton as against \$25 not so many years ago. The foreign shipyards are overcrowded with work; orders will not be taken for delivery till well into 1914. Here is an opportunity for the American builder. Why not try for orders from foreign shipowners? There is an urgent demand for tonnage. It is more than likely to continue for the next two years at least. The difference between the costs here and abroad for building the same type of steamer has narrowed down to about \$10 per ton. Perhaps some of our enterprising builders might cut the difference still further. Isn't it worth the trial? Especially as shipbuilding material is now on the free list, and the American shipyard is for the first time placed on a nearly even footing, as far as the first cost of its material is concerned. As a matter of fact to-day British shipyards are inquiring for material in the United States.

There is no question that an American merchant marine would be of benefit to every American industry, and if a plan is devised whereby the shipper, the laborer and the builder can all benefit, there will be but little hesitation in securing aid from the United States Congress. To bring this about, Congress could be induced probably, to consider paving subsidies to American-built ships operating to foreign countries, not adjacent, on a basis that would generously offset the difference in the cost between the foreign-built and American-built ship, and in addition half subsidies should be paid to American-owned foreign-built tonnage officered and manned by Americans and operated under the American flag.

All such steamships accepting subsidies should be forbidden to enter into agreements with foreign lines covering rates of freight or passenger rates, and the Interstate Commerce Commission or some such similar body should have the right to pass on the fares for passengers or rates on freight and to say that the same are fair and equitable. Acceptance of government aid should carry with it the right of government supervision.

Legislation for the aid of special industries is going out of fashion, if conditions are such that the assistance of the Government may justly be invoked, then the measure of the aid should be such that our manufacturers and exporters as well as importers and shipbuilders will also be benefited. This desired result cannot be brought about by any such indirect means as differential duties, whatever the benefits in the early days of the republic, they would under present conditions lead to a practical monopoly in many lines of ocean freighting.

Foreign governments would counter in a similar manner in favor of their own tonnage. American importers that are able to supply steamers with full cargoes would reap practically all the benefit, and to the average American importer or exporter no benefits may be looked for as far as lower ocean rates are concerned. The upbuilding of the American merchant marine should benefit our manufacturers, exporters, and importers equally with shipbuilders, shipworkers, and sailors. And if we are to have the foreign markets that our growing manufacturing industries demand, the American merchant marine must be in a position to make lower rates in case of need than can foreign steamship lines.

Conditions are more in favor of the American shipbuilder than has been the case for many decades. The cost of the material to the foreign builder is constantly increasing, due to higher wages, to higher cost of ore, and to higher cost of coal, whereas our output of iron and steel is increasing at a tremendous rate and it is fair to believe that the cost of material will be much in favor of the American shipbuilder in a comparatively short time.

Our trade between South American countries is rapidly increasing, and could be much more rapidly stimulated, were there American lines of steamers plying between South American and United States ports—fast steamers equal to, if not surpassing, the type of steamers that foreign steamship lines put on the service between South American ports and Europe. These steamers should be such as will attract passengers in goodly numbers, and we ought to aid them with adequate subsidy, but there should be no strings to government aid, it should be so broad that any American company wishing to engage in the ocean foreign carrying trade can secure a share of the aid on equal terms and conditions. This has not been the case with any measure of government aid introduced into Congress in recent years, and this phase of the past subsidy bills did more to kill off the various measures than opposition to the principle of subsidy itself.

Chicago, Ill. CHARLES DEFREEZE.

The Tallest Office Building in the World

Erection of the Woolworth Building, New York

FOR the present at least the tallest office building in the world will be found on the western side of City Hall Park where the towering Woolworth Building lifts its glittering steel and terra cotta structure through a sheer height of 785 feet above the sidewalk. This is not only the loftiest office building, but, if we except the Eiffel tower, it is the tallest structure of any kind as yet erected by man. Two other notable buildings in this city vie with the Woolworth tower in altitude, its nearest competitor being the Metropolitan tower at Madison Square with a total height of just over 700 feet, and the Singer tower, built like the Woolworth structure, on Broadway, and only a few city blocks to the south of it, which has a total height above the sidewalk of 612 feet. Mention should also be made of that remarkable structure on the opposite side of City Hall Park, the New Municipal Building, the top of the bronze figure with which it is now being crowned will be 560 feet above the sidewalk.

As the eye ranges up through the multitudinous stories of the Woolworth Building to the pyramidal structure at its top, the question arises as to what is the limit of height to which a habitable building can be carried. The answer is to be found in a certain restriction laid down by the Building Code of New York city, which states that on a rock foundation the load may reach but not exceed 15 tons to the square foot. It will surprise some of our readers to learn that on this basis, it would be possible on a plot of ground 200 feet square to erect an office building 2,000 feet in height, and to build it moreover, so that it would be perfectly secure against the fiercest hurricane, and, because of its elasticity, even against the altogether improbable event of an earthquake shock.

Some Dimensions and Quantities.

The Woolworth Building is taller than it looks. To reach its lowest foundation, we must go down in one place to a depth of 120 feet beneath the sidewalk—for that was the depth to which it was necessary to sink the pneumatic caisson in that particular spot before the solid rock of Manhattan Island was reached. This would make the total height of the building from lowest foundation to summit 905 feet. Just here while touching on the question of dimensions and quantities we may state that the building contains 23,000 tons of structural steel, 17,000,000 common brick, 7,500 tons of terra cotta, 1,800,000 square feet of floor tiles, 1,800,000 square feet of partition tiles, and 2,500 square feet of cut stone.

The construction of the foundation, etc., involved 100,000 yards excavation, the use of 24,000 yards of concrete, 400 tons of reinforcement steel and 150 tons of steel sheet piling. Finally, the building which with its furniture, etc., will weigh more than 125,000 tons will have cost, when complete, some $12,000,000.

The building covers a plot 155 feet by 200 feet. It is L shaped in plan, with two wings 00 by 05 feet, facing on Barclay Street and Park Place. The shorter side of the plot is that on Broadway. There are thirty stories in the main building, the roof of which stands four hundred feet above the street. From the center of the Broadway façade and flush with it rises a tower measuring 85 by 86 feet, which extends for an additional twenty-five stories above the roof. The building is carried on 66 concrete piers, sunk through gravel, sand and hardpan, everywhere to solid rock, which was found at an average depth of about 80 feet below the ground water level. These foundation piers are of solid concrete. The majority are circular and vary in diameter from 8 to 10 feet. A few of them are of rectangular cross-section.

Until the hardpan was reached, the sinking of the caissons was quickly and rapidly done, and one, 6½ feet in diameter, went down 80 feet in less than a single day.

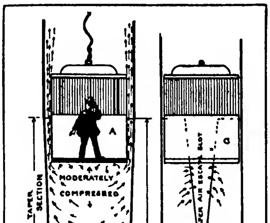
Erecting the Steel Frame.

Although the vertical axes of the majority of the columns coincide with the axes of the concrete piers below them, this is not always the case. Several of the columns are supported upon two piers, the piers being spanned by girders with the columns resting at about their center. Thus, in one column the load of nearly five thousand tons is carried at a center of a girder 8 feet deep, 6 feet 11 inches wide, and 23 feet long, which itself weighs over one hundred tons. Ordinarily between the piers and the foot of the columns is a grillage of several tiers of 24-inch I beams.

Naturally the columns in a building of this height ran up enormous dimensions and weights in the lower stories. Usually they were built in two-story lengths, and were of entirely inclosed box section, consisting usually of two channels with cover plates on both flanges. The largest column measures 34 inches by 30 inches, and its cross-sectional area is 660 square inches, that is to say, the metal in it, if compressed into a solid square bar, would measure 25 inches on each side. It is easy to understand from these dimensions that the total weight of the structural steel reaches 23,000 tons.

To Resist Wind Pressure.

When it is borne in mind that the storms which sweep across Manhattan Island, chiefly from the west and southwest, rise at times to cyclonic force and blow at a velocity of between 80 and 90 miles an hour, it can be understood readily that special provision had to be made, in designing so lofty a tower, to safeguard it against overturning or against failure in its steel frame due to the enormous bending stresses engendered. It is considered that for a building of this magnitude



The figure on the left illustrates the air cushion built with a tapering or flared top and as the elevator descends through this the air escape is automatically reduced. The vehicle being checked without violence in its fall. A and B show the car at different points in the inclosed shaft and dropping at different speeds. The other figure illustrates the same principle of the air cushion with a taper slot for the escape of the air taking the place of the entrance flare. The dropping car in combination with this slot automatically diminishes the passage for the escaping air.

Operation of the air cushion safety stop.

it is sufficient to estimate the average wind pressure, at maximum velocity, as 30 pounds upon every square foot of surface exposed. If we disregard the shelter afforded by the low buildings at its base, we find that the total wind pressure from top of tower to sidewalk over the whole surface facing a westerly wind is 1,800 tons, and this pressure may be considered as concentrated at a level of say about 300 feet above the sidewalk. It is evident, at once, that in order adequately to take care of this wind load, special features had to be introduced into the design of the steel framework. The inclined steel rafters of the spire-like roof of the tower take care of the horizontal thrust of the wind. Below the roof at the forty-second floor, the wind stresses are provided for by the wall girders and the columns, which are connected by deep gusset plates at their intersection. From the forty-second to the twenty-eighth floors, deep wall girders, made specially heavy for the purpose, are connected to the columns by double knee-braces. From the twenty-eighth floor to the street, heavy solid plates of steel, or "portals" as they are called, are constructed on the two sides and top of each opening or panel in the steel work. It was these portals that gave an appearance of enormous width to the columns before they were closed in by the terra cotta and stone work. On the Broadway front the portal girders are double as far up as the fourth floor, and they are no less than four feet in depth.

Fireproof Construction.

The floors of the basement and first story are built of reinforced concrete slabs, and the floors above of hollow terra cotta. The structural steel is protected against fire by a coating of concrete not less than one inch in thickness, or else by 3 inches of terra cotta. Wood as a material of construction is entirely excluded, the windows, the trim, the doors, are of pressed steel, and furthermore, the exterior windows where exposed are glazed with wire glass. In addition to the twenty-six elevators there are four wide stairways. A description of the installation of steam heat, ventilation apparatus, plumbing, drainage, gas and electric light, pneumatic service, etc., would make a long story by itself.

The building was commenced in September, 1910, and it is to-day practically ready for occupation. The rate at which the building was carried up is shown in the accompanying set of illustrations, which were taken from a lofty building on the opposite side of City Hall Park.

Safeguarding the Workmen and the Public.

An interesting feature of the construction of the Woolworth Building was the fact that the advanced ideas that underlie modern liability insurance were exemplified in an interesting manner, the inspection service rendered during the work being particularly worthy of note. The insurance company that carried the liability kept two inspectors on duty continuously, and immediately upon noting a condition which was likely to result in an accident, they notified the proper foreman or superintendent, and saw that the danger was removed. Their recommendations were also reported to the office of the engineering and inspection division of the insurance company, and written copies were then sent to the contractors.

Patent scaffolds were used for the bricklaying throughout the work, and these were covered, so far as possible, with substantial wire-mesh roofs, to protect the men at work upon the platforms from tools and materials that might fall from above. The sides of all the scaffold platforms were also protected by guard rails and by wire-mesh screens. Substantial bridges for the protection of pedestrians and others were built over the sidewalks, and these were made stout enough to resist the impact of any material that might fall upon them. Platforms 20 feet wide were also built out from the building at four different heights, to catch any material that might fall, and prevent it from descending into the street. Wire-mesh screens were arranged along their outer edges to give still further security.

All the hoisting apparatus was examined frequently and thoroughly by expert elevator inspectors, employees were not allowed to ride on material hoists, and the maximum number of persons who might be permitted to ride on a passenger hoist was definitely specified in each case. All hoists, whether used for the transportation of men or of materials, were covered overhead, to prevent accidents from falling objects. The hoist openings were effectively fenced, and were guarded by rails where the materials were loaded or unloaded. Openings in the floors were thoroughly guarded by rails or fences or otherwise. All stairways, whether temporary or permanent, were required to be rail guarded. Proper lighting was insisted upon, particularly at work places, along gangways and passages, and at every other important point. Warning signs were put up at all dangerous places. Laborers engaged in cutting concrete and other similar substances were obliged to use chisels fitted with protective handles, so that their own hands would not be injured if the strikers should miss the heads of the chisels. An effective watch was kept for nails and other similar sharp metal points projecting from the woodwork or from loose planks or boards or elsewhere. These are prolific sources of injury, and the men were required to remove them at once. First-aid cabinets were also provided, at the suggestion of the liability inspectors.

It will be apparent that the comparative freedom from accident that characterized the erection of the Woolworth Building was not the result of chance, but that it was the logical outcome of the practical system of inspection that was adopted.

A Remarkable Elevator Test.

The express elevators of the Woolworth Building

have a vertical travel of 676 feet, and Mr F T Ellithorpe, who is responsible for the safety system provided for the twenty-eight elevators, will make that sheer drop to demonstrate that his apparatus is equal to the maximum stress to which it may by possible mishap be subjected in service. What is technically known as an "air cushion" will first check the car and then bring it to a gentle halt From the bottom of each shaft upward for a distance of 137 feet the passageway is inclosed, forming the envelope of the so-called 'cushion." Of course, there are doors at each floor but these are closed mechanically as the elevators pass onward. The broad essential is that the surrounding casing shall be substantially air tight and that there shall be no escape for the air except upward past the sides of the descending vehicle. For the major part of its travel down this inclosed shaft, the space be-

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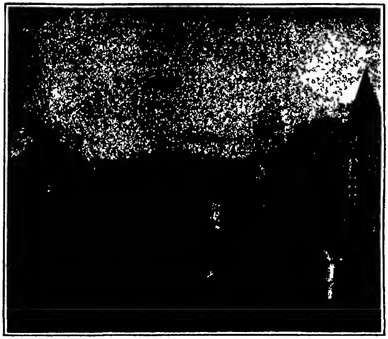


December 20th, 1911

February 28th, 1912.

April 28th, 1912.

June 27th, 1912

August 27th, 1912.

THE TALLEST OFFICE BUILDING IN THE WORLD.

Photograph by Hoppe

Sir Joseph J Thomson.

What is Matter?

The Individual Molecule Revealed

To observe the infinitesimally small, we must impart to it proportionally intense properties Thus Sir J J Thomson shoots molecules with a muzzle velocity of 12,000 miles per second from an electric gun with a two-hundredth inch bore and from the pattern at the target deduces the mass of a molecule of which five thousand million million millions make a drop of water Molecules possessing a very high velocity are also known to us in a particles shot out by radium, which Sir William Ramsay has proved to be molecules of helium His latest contribution to science seems to point to the building up of the atom the synthesis of matter —EDITOR.

Sir William Ramsay.

Has Matter Been Synthesised?

An Account of Some New Experiments

By J W N Sullivan

THE immense amount of work which has been done on the radio active substances has rendered familiar to us the notion of the disintegration of matter We know that the last elements of the periodic table those possessing an atomic weight between 220 and 240, are not entirely stable but that the heavier elements are gradually changing into others of less atomic weight These elements disintegrate at very unequal rates, so that the element uranium takes 7 500 million years to change into the element radium while the average life of radium is only 2500 years. And the extraordinarily active substance known as radium emanation lasts on an average for only 5 4 days It is probable that the final stable form assumed by uranium in its successive disintegrations is lead, and that it passes through about thirty intermediate forms before it reaches this stage

It is an extraordinary fact that we find helium almost invariably associated with these changes. Helium whose atomic mass is 4, is a monatomic gas and is completely inert forming no chemical compounds Neither is it chemically absorbed by any substances whatever and of all gases it is the most difficult to liquefy Nevertheless, this uncondensable, unabsorbable gas was first found on earth (it had been known for some time to exist in the sun) in certain minerals which also contained uranium and thorium This fact in conjunction with those furnished by our study of the radio-active substances in detail leads us irresistibly to the conclusion that helium is one of the ultimate products of the spontaneous change of the elements. These phenomena of disintegration naturally cause us to ask Can the converse change occur in nature? Can matter be synthesised and the heavier elements built up by suitably operating upon those of less atomic weight? We seem now to be in a position to give an affirmative answer to these questions

On February 6th at a meeting of the Chemical Society in London Sir William Ramsay read a paper on "The Presence of Helium in the Gas from the Interior of an X ray Tube" and Prof Collie in conjunction with Mr Patterson read their paper on the presence of neon in hydrogen after the passage of the electric discharge through hydrogen at low pressures Sir William Ramsay on breaking old X ray tubes and analyzing the gases contained in the glass had found helium neon and argon the last named gases being two of the rare constituents of the atmosphere Last November, instead of breaking the bulbs, he had strongly heated them when again by spectroscopic analysis, he had found helium and neon So far the evidence is conclusive that helium certainly exists in old X ray tubes, but when we discuss its origin we are confronted by alternatives In working an X ray tube numbers of electrons are continually being shot out from the cathode It is indeed the sudden changes in velocity experienced by these minute bodies when they come in contact with the walls of the tube that give rise to X rays It is possible therefore that helium and neon existed in minute quantities in the cathode or the anti-cathode or in the glass of the tube, and that the violent bombardment of these by the electrons set the gases free. A further experiment of Sir William Ramsay's was to treat water with radium emanation. It was expected that helium would be found but actually neon was obtained. The atomic weight of neon is 20, and this suggests that it was formed by a combination of helium, whose atomic weight is 4, with oxygen whose atomic weight is 16. This suggested combination is borne out by the extremely interesting experiments of Prof Collie and Mr Patterson

Mr Patterson had thought that by doubling the charge on a hydrogen atom it might be possible to produce an a particle such as is shot out by radium and is known to be helium But on sparking the hydrogen Mr Patterson obtained neon

The possibility suggested itself that this neon came from the outside air the glass vessel conceivably allowing it to pass under the action of the electric bombardment. But on surrounding the tube by an outside vessel containing neon, and then helium, the same results were obtained as before. Further, the condition of affairs was not altered when the outer surrounding vessel was highly exhausted so as to form an almost perfect vacuum The neon still appeared in the inner tube in perceptible quantities. But the most startling discovery was made a few days before the meeting of the Chemical Society Prof Collie decided to test the outer highly exhausted chamber to see if there was anything in it On letting in a cubic centimeter of oxygen there was a slight explosion, due to hydrogen The oxygen was absorbed in the usual way by carbon but it seemed impossible to completely absorb it. On testing this residual gas by turning on the induction coil the tube was found to be ablaze with helium, with some neon mixed.

Mr Patterson made the experiment and found helium in the outer tube, but on varying the experiment by first filling the outer tube with oxygen, he found neon there So that we are again led to look upon neon as being formed by a union of helium and oxygen It would seem that the helium formed by the passage of the electric discharge in the inner tube has sufficient velocity to penetrate through the glass walls into the outer chamber and to combine there in some way with the oxygen to form neon.

If the helium in the inner tube is formed from the hydrogen, we may obtain some idea of the mechanism of this change by recalling some of the fundamental notions of the electron theory On that theory the atoms of all elements are made up of systems of electrons, the electrons being in a state of rotation according to certain laws. If now one of these complicated systems be struck by a free electron, moving with a velocity comparable to that of light, such as are produced in numbers in a cathode tube, we should expect something in the nature of a catastrophic splitting up of the original system, and the subsequent recombination might assume another of the standard forms which we call elements. Some time ago Sir J J Thomson published a very interesting investigation showing the way in which the various elements might be formed by appropriate groupings of their constituent electrons, and accounting for many of their chemical properties by this hypothesis.

Although the synthesis of matter is theoretically possible, yet before we admit that so important a result has actually been obtained, we must exercise a due amount of scientific caution. Thus the investigators whose work we have been describing point out that the gases found may have been originally present in the glass of the vessel or in the electrodes. However that may be, it is certain that in previous experiments of this kind, it has ultimately been found that such has been the case Sir J J Thomson, whose supreme eminence in this class of work cannot be questioned, is of the opinion that nothing further has been done in these new experiments than to liberate the gases already contained in the apparatus, and he points out the extreme difficulty of successfully eliminating these gases before subjecting the tube to the electric bombardment He had himself, as a result of his own experiments, believed for some time that he had discovered a new element of atomic weight three, obtained from the hydrogen in his tube but subsequent investigations had proved that this idea was unfounded [Sir J J Thomson's present view is that this substance is a polymerized form of hydrogen, as explained in another article on this page—EDITOR.] Sir Oliver Lodge and Mr Soddy are also inclined to think that the new experiments do not differ essentially from others in which observers had mistakenly supposed that they had accomplished the synthesis of matter So that we do well to be cautious. Science differs from other human activities in the superior quality of the evidence that it produces for its assertions, and it is a point of honor with a scientific man not to believe easily But whether future investigations confirm or refute the claim that matter has been synthesised, the new experiments have greatly aroused the interest of intelligent men and directed attention to matters which are usually ignored, and in that respect at least have done science a service.

In the World of Molecules

By Alfred J Lotka, M A., D.Sc.

MANY hundred years ago a Greek philosopher made an astute guess, that matter is composed of small particles, so small as to escape the direct observation of our senses, but themselves not further divisible—atoms. Centuries have lapsed, and it was reserved for this generation, not only to prove the existence of the atoms, but to weigh them and to count them one by one. (It must be remarked, however, that the typical atom is not incapable of further subdivision, according to the present state of knowledge.) What an exquisite achievement of scientific genius this represents, the reader may realize when he calls to mind the order of magnitude of some of the dimensions involved. It is almost useless to quote figures, as the mind fails to comprehend the immense ratios involved A graphic example is more helpful If a drop of water were magnified to the size of the earth, the molecules in it would be of the size of foot balls.

How, then, has the physicist succeeded in measuring, weighing and counting these elusive particles, utterly beyond the reach of the ordinary microscope, whose power is exhausted in detecting structures some thousand times greater in linear dimensions than a simple molecule? Even the ultra-microscope extends the limit of visibility only a little farther, to particles about fifty times smaller than those discerned by the microscope.

An exhaustive answer to the question raised cannot be given here. For details the reader must be referred to the splendid articles by Svedberg, Aston, and others, which have appeared in recent issues of the SCIENTIFIC AMERICAN SUPPLEMENT. We must content ourselves here to pick out one or two points of special

interest How has the physicist accomplished the stupendous feat of counting individual molecules?

Radium, which, fifteen years ago, came upon the scene of physical science, holds the key to this, as to so many wonders of modern science

If the atom of helium is small, it possesses a terrific velocity when shot out (as an α particle) from a radium molecule undergoing disintegration. Such an atom, moving at the rate of 12,000 miles per second, a speed which would carry it from the earth to the sun in the space of two hours, is allowed to impinge upon a screen of zinc blende, where it produces a visible flash of light, a scintillation as it is termed technically This fact has been made use of in counting helium molecules.

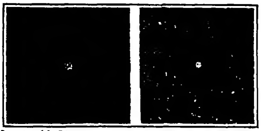
But the art of the physicist does not stop here. He is not dependent on the bounty of nature for his supply of rapidly moving molecules Sir J J Thomson in his monumental researches, has taught us how to train a miniature gun at a target and shoot molecules with one tenth the speed of light Charged molecules moving at such speeds behave like electric currents, and, like these are deflected by a magnetic field. The amount of this deflection, and of the deviation produced by an electric field, enables the observer to determine the mass of the molecule. The molecule, as it were, is made to weigh itself, and to register its weight on a photographic plate.

No wonder with such methods as these that Sir J J Thomson is reaping a harvest of remarkable new discoveries. The delicacy of the process is such that by its means quantities of helium for example, which the spectroscope fails even to reveal, are not only detected and identified but are made to register their atomic weight (The quantity of substance required is about one hundredth of a milligramme or one three-millionth of an ounce) Only the chemist, who knows the intricacies and tedious labor involved in an atomic weight determination by ordinary methods, can fully appreciate the significance of this. The chemist too, may presently learn to appreciate the value of a method which enables us to deal with molecules or radicles having a brief life of one ten millionth part of a second. It may perhaps appear at first sight as if a substance of such short duration could not possibly ever gain any practical interest But it must be remembered that in every chemical reaction matter must pass through transient stages intermediate between two compounds. While the existence of such evanescent states of matter has been more or less vaguely realized and has been clearly referred to by Schönbein for example the chemist using the ordinary established methods of work was utterly incapable of even approaching the study of these transient states of matter Sir J J Thomson has now shown us the open door through which this domain of chemistry may be approached, and we may expect that the future, perhaps not the immediate future, will bring important elucidations in this direction, and will perhaps, among other things, give us an insight into the *modus operandi* of catalysers. As it is, Sir J J Thomson has observed such transient substances as CH, CH_2, CH_3, and others. Another discovery which is not yet fully explained is that of a substance having molecular weight 3. It is difficult to explain this in any other way than by attributing it to triatomic hydrogen H_3, although no such substance had hitherto come under observation.[1] The gas has been obtained by submitting various materials to cathode ray bombardment, and Sir J J Thomson inclines to the view that it is originally contained in these materials (aluminium, platinum, etc.) and is in some way released by the bombardment. These observations have quite recently acquired particular interest through the publication of a paper by Sir William Ramsay, Prof Collie and Mr Patterson, who have obtained evidence of the apparent formation of helium and neon under remarkable circumstances. It may be that these gases are present initially and are merely released under the conditions of the experiment.

[1] Sir J J Thomson's latest report on this subject, a lecture before the Royal Institution, is reproduced in this week's SCIENTIFIC AMERICAN SUPPLEMENT, to which the reader is referred for details. He will there find also some very significant comments by Sir J J Thomson on the work of Ramsay, Collie, and Patterson, while another article in the same issue describes the experimental arrangement employed for observing the "scintillations" referred to above.

Optical Illusions; Trust Not Your Eye

THERE is an old proverb "Seeing is Believing" Like many old sayings, it is far from being fully justified We believe and justly in the existence of many things that we do not see such as for example molecules, and what is at times even more important, we cannot always trust uncritically to the seemingly plain evidence of our senses. How very much we are subject to error of perception and of memory has been well brought out by Prof Münsterberg among others, in his well known popular exposition "On the Witness Stand" But even a mere sense-perception, quite apart from pranks played on us by our deficient and deceitful memory may be deceiving to an almost unbelievable extent Various "optical illusions," as they are called, have long been known and we reproduce herewith several classical examples, together with two or three of more recent origin which surpass all others in their convincing" power



By courtesy of La Nature

Fig 1.—A pattern made up of oblongs? No, concentric circles!

Fig 2.—A spiral which is not a spiral. What is it?

Three of the illustrations shown here belong to one type- in each case the optical illusion relates to certain angles. Thus, in Fig 1 the horizontal lines appear bent converging at their ends. As a matter of fact, they are perfectly straight and parallel A similar effect is produced in Fig 6 by the cross hatching, which gives a zigzag appearance to a set of parallel straight lines. In Fig 7 you are asked to trace one line *ab*, which is partly covered up Is *ab* straight, or is *ac* straight? Answer the question by eye, then try a ruler to prove your answer

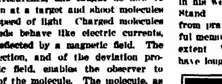


Fig 3.—What is the form of the central white band in this drawing? Try it out with a ruler

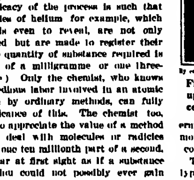
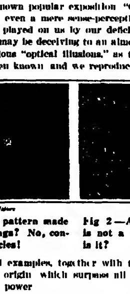


Fig 4.—What is the relative length of the horizontal lines in the four figures above?



By courtesy of La Nature

Fig. 5.—In selecting material for a garment it is well to consider the deceitfulness of appearances.

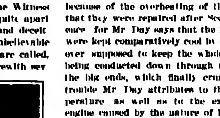


Fig 6.—The long lines appear to run in zigzag You may not believe they are parallel until you have measured the space between them

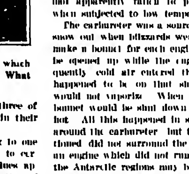


Fig 7.—A "straight" line which is not a straight line, and one which is.

A somewhat different type of illusion is illustrated in Fig. 4 In this case it is the length of a line which is deceptive. Of the horizontal lines in the four parts of this figure, which is the shortest, and which the longest? Measure them with a ruler and see

But of all optical illusions the most convincing are those shown in Figs. 1, 2, and 5. Do you see the spiral on the right, Fig. 2? Well, it is not a spiral but a set of concentric circles! You do not believe it? Get out your compasses and try As for the figure on the left, how would you describe its pattern? See what the compasses say about it

Our last illustration may appear somewhat frivolous. We might draw from it the practical lessons that it pays to consider the effect of the pattern of your trousers if you are vain about the shape of your legs.

Scott's Motor Sledges

IN a recent number of *The Car* Bernard C Day discusses the sledges that Scott took with him on his ill fated antarctic expedition Day's account is interesting because he drove one of the sledges Moreover he had previously been in charge of a motor van with Capt Shackleton's expedition of 1907 to 1909

Scott took with him two motor sledges each capable of carrying two tons. Mr Day states that the sledges covered one hundred miles over soft surfaces upon which rested from two to eight inches of snow The top of this surface seemed to have the consistency of sand rather than of snow at very low temperatures. The sledges were driven by 14 horse-power air cooled engines with the cylinders cast in pairs. Mr Day states that the engines worked splendidly although Scott himself stated in a paper sent to civilization just before he made his dash for the pole that they were stalled because of the overheating of the engines. It may be that they were repaired after Scott narrated his experience for Mr Day says that the front pairs of cylinders were kept comparatively cool by a fan, which was, however supposed to keep the whole engine cool the heat being conducted down through the connecting rods to the big ends, which finally crumbled to pieces. This trouble Mr Day attributes to the great range of temperature as well as to the excessive strain on the engine caused by the nature of the surface over which the sledges had to travel The heat however did not melt out the white metal On examination the phosphor bronze was found to have become crystallized and had apparently fallen to pieces, as aluminium does when subjected to low temperatures and undue strain

The carbureter was a source of anxiety To keep the snow out when blizzards were raging Mr Day had to make a bonnet for each engine and this bonnet had to be opened up while the engine was running Consequently cold air entered the carbureter if the wind happened to be on that side and then the gasoline would not vaporize When the engine missed fire the bonnet would be shut down and the engine would run hot All this happened in spite of the exhaust jacket around the carbureter but the jacket it must be mentioned did not surround the choke tube The fact that an engine which did not run hot in Norway ran hot in the Antarctic regions may be attributed to the intense dryness of the southern atmosphere

In a dispatch published in the New York *Times* Commander Evans states that Scott and his companions after having determined that they were within half a mile of the pole marched on to the desired spot taking with them their motor sledge and there planted the Union Jack Can it be that Scott had underrated the motor sledge in his earlier accounts?

Buying Oil in Original Packages

HOWEVER thoroughly he may have studied the mechanical construction of his car the average automobile user pays but scant attention to the matter of lubricants. He buys some widely advertised brand of oil and trusts to the honesty of the garage keeper that the oil asked for is supplied. While the better class of dealers give the particular brand demanded, the temptation to substitute is unquestionably yielded to by the less scrupulous. Just as some wine dealers supply five different varieties of wine from a single cask, so the dishonest automobile supply dealer or garage keeper sells many different brands of lubricants from a single barrel Since many oils are alike in color it is difficult to identify the lubricant thus supplied The motorist's best safeguard is to follow the practice of wise housekeepers of buying only in original packages. Practically every known trade-marked brand of oil is sold in barrels, half barrels, and in five-gallon tins. The name is on the containers, and in most cases the containers are sealed Unless the motorist buys in these original packages he has usually but little assurance that he is getting the oil he asks for Therefore, the trade-marked and labeled tin is to be preferred in most cases.

Inventions New and Interesting

Simple Patent Law, Patent Office News; Notes on Trademarks

A New Tire for Motor Trucks

By C. Francis Jenkins

IN motor truck construction, the tire problem has yet to be solved. Motor, transmission and steering gear have been worked out to a practical basis but tires do not wear correspondingly. The life of the solid rubber motor truck tire is so short that tires cost more than all the other running expenses added. The tires do not wear out, they simply go to pieces under the pounding of the cobble-stone streets. And the thicker the rubber the greater the loss. For this reason thin tires are frequently recommended for heavy trucks, rubber being employed almost exclusively.

If therefore something can be found which will give as good traction as rubber, cost less and wear longer, it will merit serious consideration and extended tests. Wood seems to fulfill these conditions admirably and so tests of wooden tires were undertaken.

Wood is proving its good qualities in similar service, i. e., in street paving, ferryboat and warehouse flooring, and such other surfaces as are subjected to excessive attack. It has been so in use for a long time, and has proved superior to other materials, especially in its excellent adhesive qualities. Its surface does not become slippery in wet weather.

These qualities, i. e. good traction and long wear, recommend the use of wood as a truck tire and at first the question seemed simply a matter of selection of the suitable wood. After a long search and much experimentation a wood was found which seemed to lend itself admirably to this service. And it could be had in sufficient quantity, *and*, fortunately, is not very suitable for anything else. It is close-grained yet soft enough to make it practically noiseless, and so tough that it cannot be split with an ax. The grit of the roadway buries itself in the tough end grain of the wood and provides most excellent traction as good as solid rubber in dry weather and a thousand times better on a wet street.

There was one initially insurmountable difficulty however, the tire would expand when it got wet and then when it dried out again the blocks would separate and the tire would go to pieces. The contraction and expansion wasn't much, to be sure, but it was enough to ruin the tire. This difficulty was finally overcome by the very simple expedient of imbedding in the tire a powerful spring band either a heavy spiral spring entirely inclosed in the tire, or sinuous flat spring bands located in a shallow groove in the tread of the tire. The blocks which constitute the tire are doweled together laterally inclosing the spring band, and then after being thoroughly dried the tires are placed in a vacuum chamber and impregnated with a water repellant.

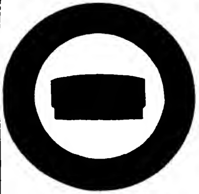
Such a construction makes the tire integral and capable of being handled, shipped, marketed and used as conveniently as a rubber tire. They should, of course, be made in all standard sizes and in such widths of tread as may be required by the loads to be carried.

Thus apparently an entirely satisfactory tire for motor trucks has at last been evolved. A tire made up of blocks of wood set like street paving blocks, with the grain end on to the point of attack, that is with the grain of the wood radial to the wheel, and having a powerful spring band imbedded in the tire to hold the blocks in place and compensate for longitudinal contraction and expansion. It is easily and quickly secured in place on the wheel, the driver simply unbolts the old rims, throws away the worn out tire, and replaces it with the new tire.

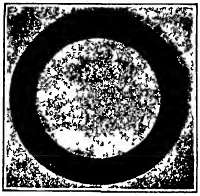
These tires will travel over softer ground, last many, many times longer than solid rubber tires, and cost but a small fraction as much as rubber for the same loads. They are noiseless, and give better traction and do not skid on wet pavement.

Wooden tire showing peripheral spring band.

At first it was thought that perhaps, the use of solid wood tires might transmit too much shock to the motor mechanism but this was disproved in actual service, as shown by the records made in an instrument for showing the vibration and shock when the wheel was shod with solid rubber and then with the new solid wood tires.



Wooden tire, made of blocks and fitted with demountable flanges. In center is a cross-section of tire, showing imbedded springs.



Wooden tire before flanges are applied. It is set with the grain end-on, that is, the grain of the wood is radial to the wheel.

An electric meat slicer fitted with an automatic knife sharpener

The Tismer engine, showing the method of feeding fuels of different types.

An Automatic Sharpener on an Electric Meat Slicer

By Frank C. Perkins

THE accompanying illustration shows a novel automatic meat slicer which is operated by either an electric motor or by hand, and is an efficient labor saving device.

The first useful slicer was invented in 1890 by Mr. W. A. Van Berkel, a practical butcher of Rotterdam, Holland, and this machine was a great advance on the old method of slicing by hand knife. After a time, as with most inventions, experience proved that the machine was not a perfect proposition as one of the most important defects was the impossibility of keeping the knife sharp enough to prevent loss of waste meat due to damaged slices.

The secret of the successful working of this new slicer with an automatic sharpener is in maintaining a keen edge on the knife all the time. The automatic sharpener is an ingenious device, is always ready for use and is operated by simply turning the handle of the machine. The work is done in a few minutes, it keeps the knife in perfect condition, and is readily adjusted to take up wear. It saves time and labor and abolishes the risk involved in the use of the old hand stone.

A knife guard is provided which prevents the operator's hand coming in contact with a knife, and it is so arranged that the user cannot cut himself, hence is far safer to handle than the ordinary hand knife.

Should the electric motor be out of commission the slicer can be converted to hand power in a few seconds. The electric motor is belted to the slicer from below the counter, the slicer being fitted with intermediate gear for use in speed reduction.

An Engine That Will Run on Several Fuels

THE present high price of gasoline and the probability of still higher prices in the future have brought the fuel question into such prominence that more than ordinary interest attaches to any plan that promises relief or suggests possibilities in the way of lowering construction and operation costs.

Whether or not the motor designed—or to speak correctly converted—by P. G. Tismer of New York is all that is claimed for it in the way of a consumer of heavy oils of almost any kind, remains to be proven by actual commercial service in the hands of disinterested users. In the mean time one motor now is running to demonstrate the principles involved. It is in the hands of the inventor, however, who cannot, even if he would, handle the engine as a stranger would handle it. That there is much that is of interest in the engine, however, may be gathered from the fact that it runs on various hydro-carbons ranging in density from gasoline and crude oil to gas house tar without other adjustment than the changing of the feed valve opening, that there is no special fuel feeding mechanism, such as a pump, pressure system or spraying device, that there is no cooling system, either air or water, and that though there are no rings on the piston there is apparently no more loss of compression than in an engine with a ring-packed piston.

The Tismer engine is an old-fashioned machine of the vintage of the days of hot tube ignition, with certain alterations in more or less important details. It operates on the straight four-stroke Otto prin-

ciple, however, and cannot in any way be compared with engines operating on the Diesel principle.

It has a single horizontal cylinder with a bore of 3⅛ inches and a stroke of 4⅝ inches, both valves are in the cylinder head, the inlet valve being of the automatic type. The changes that have been made tend to simplify rather than to complicate. The cylinder has a water-jacket, which, however, is empty, the water pipes having been removed and the jacket left merely a useless appendage. A new piston has been made, the chief characteristics of which are that it is a plain cylinder with no packing grooves, fitting the cylinder with a clearance of one half thousandth inch all around, and that it is deeply recessed at the head. The recess forms by far the greater part of the combustion chamber, and the piston approaches very near to the cylinder head.

The intake pipe with its throttle valve remains, but there is no carbureter, the pipe is a plain air intake and is fitted with a valve. The oil feeding mechanism consists of a small pipe leading from the fuel tank directly to the cylinder head into which it opens through a brass fitting. Oil is drawn in by suction, and is not sprayed or otherwise atomized. The spark plug is unusually located in the brass fitting that serves to connect the oil pipe to the cylinder head and its two electrodes are separately mounted and insulated, for convenience in altering the spark gap. High tension ignition is employed.

At each intake stroke of the piston, the oil drawn in passes over the spark plug points and has a cooling effect that is increased by a small current of air admitted to the fuel pipe back of the intake check valve. It seems probable that this column of air has some slight effect in breaking up the oil in addition to cooling the spark points. However, the engine runs as well without it as with it except that without it the plug points burn away rather quickly, which form of plug trouble caused much annoyance until the opening was made.

In order to make it a simple matter to run the engine alternately on any one of several fuels, the intake pipe is connected through a header having several branches leading to six small open fuel tanks containing kerosene, fuel oil, machine oil, gas house tar and the condensed oil that collects in the muffler, and is drained out from time to time and again fed to the motor. Each of the pipes is fitted with a stop cock.

As far as can be judged from watching the operation of the motor, it will burn any of the fuels in the tank with equal facility and will run at practically the same speed no matter which one is fed. The same holds true of any combination, though it would seem that when two or more cocks are open at the same time the lighter liquid forms the principal ingredient in the fuel. Unfortunately, the motor runs without load and, therefore, there is no way of determining its power on the various fuels. It is said that for a considerable period the motor was run regularly, driving the machine tools in a small shop, and that the results obtained were relatively the same as when running light. During half an hour's running there was no indication of overheating, despite the absence of the cooling system. There was no difficulty in throttling down to a very low speed and acceleration was fairly good if not remarkable. Instead of regulating the amount of fuel admitted in altering the speed of the motor, or of throttling the air passage, speed is reduced merely by admitting exhaust gas to the air intake pipe. This has the effect of reducing the amount of oil burned, the unburned portion being thrown out with the exhaust, where it drains into a sump and is re-fed to the engine.

When the motor is perfectly cold it will start readily on crude oil after two or three revolutions, it will not start on kerosene or any of the other fuels until heated, when, however, it will start readily on any of them except the oil drained back from the muffler. As to the formation of deposits, it would seem that they are avoided either by adjusting the fuel feed so accurately that there is no residue or by feeding considerable excess fuel part of which is burned and part thrown out with the exhaust. The latter method is preferred as the simplest, as very little care then is required in adjustment. The running of the motor with an excess of fuel is attended by considerable volumes of smoke with many particles of burning fuel in the form of sparks and a small amount of red flame though the temperature of the exhaust is comparatively low. With the fuel feed correctly proportioned the exhaust is exceedingly clear and is free from objectionable odors.

The ringless piston is the result of the inventor's opinion that piston rings serve no more useful purpose than to scrape the cylinder walls so clean of oil that it must be constantly replenished, moreover, that the thin film instantly is effected by the heat. Consequently the engine has been constructed upon the theory that the piston should "float" on a comparatively thick film of oil as a journal in its bearing, that the layer of oil if thick will not be effected by the heat in the short space of time required for the explosion, and that considerably less heat will be dissipated through the cylinder walls. In fact the compression of the motor is very good not only when the cylinder is cold and the oil thick, but when it is hot and the oil presumably is considerably thinned. The compression is very close to 100 pounds to the square inch.

Unfortunately no accurate tests of any kind have been made with the Tismer engine, fuel consumption, horse-power efficiency still are unknown quantities. Apparently, the inventor has concerned himself only with the production of a motor that will run on any one of a variety of fuels without material adjustment, special effort having been made to utilize gas house tar which may be purchased in some localities for as little as a cent a gallon. Laboratory tests soon are to be made, however, when we hope to be able to give a more accurate account of its efficiency, both thermal and mechanical.

The Equity Rules and Patent Causes

THAT the new equity rules will unquestionably reduce the cost and time involved in patent litigation, is almost a certainty. One of the rules states that "in the trial of a patent cause whether in open court or by deposition or partly in each way, only one expert witness shall be allowed to each side unless leave shall previously be obtained from the court on motion made and cause shown."

Whenever in the opinion of the court intricate technical or scientific questions of fact are involved in the cause the court will upon consent of all parties, appoint some disinterested person skilled in the art to act as an assessor. This assessor is to sit with the judge at the hearing of the evidence, and is to help the court in its deliberations. In this manner, the court will be able to appraise conflicting testimony properly.

The voluminous testimony which has been an unfortunate feature of patent litigation of the past is to be cut down. When testimony is taken by affidavit the witnesses shall not give their opinion as to the meaning of any patent claim or specification, but their testimony shall be strictly confined to an explanation of the operation of relevant arts, processes, machines, manufactures, or compositions of matter, and of the meaning of terms of arts or science, and of diagrams or formulæ."

Death of Tolbert Lanston

TOLBERT LANSTON, patentee of a number of inventions, but whose most important invention was that of the Lanston type-setting machine, generally known as the monotype machine, died at his home in Washington city on February 18th.

Mr Lanston early evidenced his inventive genius and took out numerous patents for inventions having more or less utility, but did not achieve any considerable or marked success with his inventions until he approached the problem of the type-setting machine which resulted in the issue of patents to him for the well known Lanston machine. This machine has gone into extensive practical use and forms the basis of a large commercial or manufacturing establishment.

Mr Lanston was born in 1844 in Ohio, and after a brief service in the Ohio volunteers in the civil war was appointed a clerk in the Pension Office at Washington, in which office he gradually arose to the position of chief clerk. He graduated at law and was admitted to the bar but on the completion of his important invention resigned his office and devoted his attention thereafter for some time to the invention. Some years ago he suffered a stroke of paralysis, which left him an invalid.

Trade-mark Notes

Trade-mark of a Selling Agent.—In Strawn v Ontario-Cucamonga Fruit Exchange, first Assistant Commissioner Billings in holding that a fruit exchange which is the selling agent for several associations of fruit growers is not entitled to register a mark used by all of them, said: "Each of the associations, therefore, having the right to use the mark during its membership in the exchange and the latter being merely a selling agent for these associations, it cannot be held that the latter has such ownership in the mark as will entitle it to registration."

Similarity of Trade-marks.—First Assistant Commissioner Billings in the trade-mark opposition of Holt & Co v Kansas Milling and Export Company, has decided that in determining the similarity of trade-marks three features must be considered—first the appearance of the words, second the sound of the words when spoken and third, the significance or meaning of those words and applying the reasoning, holds that the word "Nobility" was properly refused registration in view of the prior use by another of the word "Noblesse" as applied to the same goods.

Life-boat Apparatus.—Patents Nos. 1,043,914 and 1,043,915 have been granted to John E Erickson of Chicago. In the former a life boat is disclosed, whose structure is closed on all sides with an upwardly projecting tower and a hatchway in the upper end of the tower and a step-ladder arranged in the tower, the lower end of the tower being closed by a door and the upper end by a hatchway and a stair being provided which leads downwardly from the door into the hold of the structure. In patent No 1,043,915 are provided two spaced supporting rails with boats arranged between the rails, with studs at their ends, which rest upon the rails together with means which engage the studs, so that the boat may be moved longitudinally along the rails and lowered at the ends.

A Novel Convenience for the Filing of Patent and Trade-mark Applications.—In a decree of August 27th 1909, the Peruvian Government authorized certain of its consulates abroad to receive applications for the registration of trade-marks and by decree dated July 22nd, 1910, a similar provision was made for the filing of applications for patents. The Peruvian Government has attributed the lack of complete success of these measures for facilitating the registration by foreign applicants, to the fact that foreign patent attorneys have not come to realize that they can deal directly with the Peruvian Consulates. Certain charges are fixed and the provision seems a wise and a fortunate one especially in connection with cases in which the early filing of an application is desirable or necessary and a similar provision on the part of many of the other foreign countries would doubtless be viewed with favor.

Notes for Inventors

Branding the Dough Before Baking.—In patent No 1,044,170 William C Horner, of Indianapolis Ind describes a method of producing bread in which the dough is branded by locally applied heat after which the branded dough is baked.

A Novel Arrangement of Locomotive Cabin.—Thomas F F Lee, of New York city, has patented No 1,044,190 a locomotive in which the cab is at the front end the water tank at the opposite end and a boiler and fuel receptacle are located between the cab and the tank.

A Woman's Device for Prolonging Sleep.—In patent No 1,047,163 Helena M S Bullock shows a device for prolonging sleep in which an eye shield or band of light absorbing material extends from temple to temple over the eyes, has at each end a loop to fit around the ear to hold the eye shield in place.

A Novel Swab.—Hobart DeLancey Rapson of Philadelphia, Pa has secured a patent, No 1,047,704 for a toilet swab which consists of a large number of paper strings detachably bound together for a portion of their length by a binder which is so united as to be removed by water to release the strips.

Sentiment and a Dog Cracker. You would not expect sentiment in a dog biscuit but it is there. A patent has issued on the invention of Carleton Ellis of Larchmont New York, for a biscuit in which the dog-food mixture is molded in the shape of a bone with knob-like ends to render it attractive to dogs and to make it capable of being readily grasped by a dog.

Convertible Motor Boat and Automobile. Hartley A Mitchell of Newport News, Va has secured patent No 1,047,271 for an automobile boat which combines an automobile body and has a boat hull together with detachable wheels and detaching means which are operable from within the boat and hoisting means which are operable after the detachment of the wheels for raising the wheels into the boat.

Convertible Boat and Sled.—William Offenburger of Evergreen N Y has secured patent No 1,048,337 for a boat which has a detachable sleigh attachment comprising runners and a cradle supporting the boat with steering mechanism operable from the boat and connected with the runners and propelling means in the form of a bladed propeller operating in the air so it can drive the device either in or out of the water.

The Lazy Man's Fire Lighter. Earl Norris Swan and Alton Beightol of Scotia Cal in a patent No 1,048,172 show a fire lighter in which a match holder located in the fire box of the stove has a heating wire which holds the head of a match and an electric circuit includes the match-holding member and a circuit closer located alongside of the bed so the match can be lighted electrically without getting out of the bed.

Harnessing Child to a Bed or Couch.—Ida M Brown of Somerville Mass provides means for securing a small child to a bed or couch. This as shown in her patent No 1,048,031 includes a cross-shape anchor composed of two straps provided near their ends with safety pins by which they may be secured to the bed or couch and at the crossing point there is secured a belt on which are suspender-like devices for going around the child's shoulders, the entire device being easily applied for use.

An H Ward Leonard Patent. H Ward Leonard of Bronxville N Y has patented an electrically propelled vehicle, No 1,042,008 in which he develops upon the vehicle itself by means of a gasoline engine the power employed in the propulsion of the vehicle which power is transformed into electric energy through dynamos, and this energy is supplied to propelling motors at such a voltage and current as will cause the vehicle to travel at the speed desired. The invention also affords a simple arrangement for holding the vehicle stationary when either going up a grade or going down a grade and without brakes.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

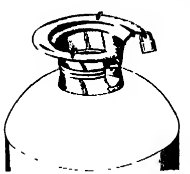
SHIRT WAIST SUPPORTER.—F. WINSLEY, care of Bartholo Manufacturing Company, Glendale, L. I., N. Y. For the purpose of this invention use is made of a tubular covering, a band extending through the covering and terminating in loops projecting beyond the ends of the covering, and a tying string doubled up to form an eye for engagement with one of the said loops.

REMOVABLE HEEL.—L. KATINS, care of Midget Manufacturing Company, 178 Center St., New York, N. Y. This invention has reference to boots and shoes, and its object is to provide a new and improved removable heel arranged to permit the user of the boot or shoe to conveniently and quickly replace the worn out heel by a new one.

Of Interest to Farmers.

CANE STRIPPER.—G. R. LUCE, corner Ingan Ave. and St. Peter St., New Orleans, La. This invention concerns itself with sugar cane harvesters, and the object is to produce a machine which can be advanced along the rows of cane, and which will operate to top the stalks of cane and strip the leaves from the stalk.

MILK CAN COVER.—H. G. THOMPSON, Campbell Hall, N. Y. The object here is to provide a cover which will form a perfectly tight closure for a vessel and be capable of being securely locked in closing position so as to prevent access to the can by unauthorized persons. For this purpose the inventor con-

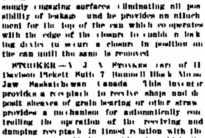


MILK CAN COVER.

structs the neck of the can and the closure which is fitted to the same so as to have snugly engaging surfaces, eliminating all possibility of leakage, and he provides an attachment for the top of the can which co-operates with the edge of the closure to enable a locking device to secure a closure in position on the can until the same is removed.

STOOKER.—A. J. A. STOCKER, care of H. Davison Pickett, Suite 7, Hammell Block, Moose Jaw, Saskatchewan, Canada. This inventor provides a receptacle to receive shape and deposit sheaves of grain bearing or other straw, provides a mechanism for automatically controlling the operation of the receiving and dumping receptacle in timed relation with the operation of a binder machine to which the stooker is connected and whereby the same is operated, and provides means for adjusting the operating mechanism of the stooker to vary the timed relation to the operation of the binder.

EYEGLASS MOUNTING.—L. E. CURTIS, I. O. O. F. Block, Main St., Windsor Locks, Conn. The invention provides a mounting having pivoted nose clips pressed on by springs and arranged to prevent the pivot from becoming loose accidentally, and to allow of taking off the springs and replacing the same without disturbing the rest of the mounting. For this purpose use is made of a bridge connected with lens clips and provided with pivots for nose clips to swing on, the springs coiled on the pivots and bearing at one end on the nose clips and engaging at the other end flattened portions on the pivot.

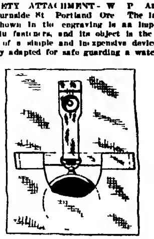


EYEGLASS MOUNTING.

INCUBATOR.—C. H. IRA, 1115 Hurney St., Omaha, Neb. This improvement provides for controlling distribution of heat within the radiating chamber, provides a mechanism for controlling the passage of heat into the chamber, and provides means disposed on the outer side of the incubator whereby the disposition of dampers for controlling the heat passages may be ascertained.

Of General Interest.

SAFETY ATTACHMENT.—W. P. ALDEN, 227 Burnside St., Portland, Ore. The invention shown in the engraving is an improvement in fasteners, and its object is the provision of a simple and inexpensive device especially adapted for safe guarding a watch by

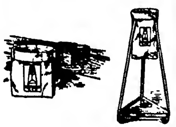


SAFETY ATTACHMENT.

attaching it to the clothing wherein a support is provided for the watch which will permit the watch to be taken from the pocket for inspection and returned without releasing the watch from the fastener or the fastener from the clothing.

BOTTLE LABEL.—G. ZITZMANN, care of Frank Shoreys, 40 Steuben St., Middle Village, L. I., N. Y. This invention relates to labels for bottles and other containers used for drugs and the like, and has reference more particularly to a label comprising a transparent face plate and a background sheet having a name or the like printed or otherwise produced thereon affixed to the back of the face plate, the label having a glazed or enamel appearance.

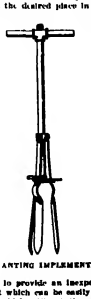
SANITARY REFUSE BAG.—J. F. RANKER and ELLEN D. RANKER, 852 Park Ave., Brooklyn, N. Y. This invention provides a sanitary refuse bag and holder for the same more especially designed for receiving refuse in households, hospitals and other establishments, and arranged to provide a convenient and cheap means for receiving and bagging the



SANITARY REFUSE BAG.

refuse for ready transportation to a place of disposal. For this purpose use is made of a bag provided at its mouth with an outwardly extending annular fold, adapted to engage a supporting ring for suspending the bag and for holding the mouth thereof open for the reception of the refuse, the fold being capable of being extended or drawn out to form a closing means for the bag after the same is filled.

PLANTING IMPLEMENT.—N. P. JENSEN, Ephraim, Utah. The invention has reference more particularly to implements which comprise means for receiving the plant and then setting it into the desired place in the ground.



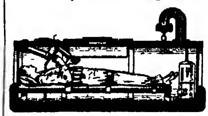
PLANTING IMPLEMENT.

The object is to provide an inexpensive planting implement which can be easily and quickly manipulated, which will set the plant in any desired position in the ground without injury to the plant. This implement is also intended for pressing the soil uniformly about the plant set in the ground.

FOLDING CROSS.—A. H. SMITH, care of Hans T. Walrow, Astoria, L. I. City, N. Y. The principal object here is to provide a cross as an article of jewelry adapted to be worn as a watch charm, the structure being provided with a pivoted member whereby it may be hung from a chain, this member being adapted to engage one of the pieces of the cross in order to bring it out of register with the other piece.

FENCE CLAMP.—J. C. MCHENRY, 1906 Grand Ave., St. Louis, Mo. This invention is an improvement in wire fence clamps and has for its object the provision of a novel construction whereby fencing material such as ordinarily found on the market, or similar material, may be clamped for stretching or for other purposes.

LIFE-SAVING VESSEL.—JUDSON DAVIS, East Rochester, N. Y. The object of this invention is to provide a life-saving vessel for

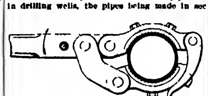


LIFE SAVING VESSEL.

use in connection with steamships or the like by means of which a person can be saved in case of shipwreck or on similar occasions, in which the person to be saved can remain safe and comfortable despite severest storms, in which the person can be freely supplied with pure air, which can be emptied of vitiated air in which water inadvertently entering can be ejected when necessary, which will not readily be injured by rocks or floating obstacles, in which the passenger is carried safely with respect to sharks and the like, and in which means are provided to prevent clogging of the air inlet valve by the freezing of water about the same. The right to manufacture this device is for sale.

Hardware and Tools.

WELL DRILL WRENCH.—W. R. OSBORNE, R. F. D. No. 7, Box 32, Palestine, Tex. In this case the invention is an improvement in large pipe wrenches, which are particularly designed and adapted for use on drill pipe used in drilling wells, the pipes being made in sec-



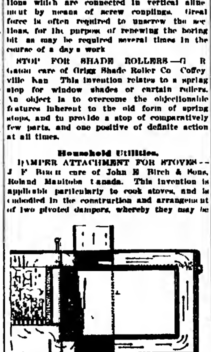
WELL DRILL WRENCH.

tions which are connected in vertical alinement by means of screw couplings. Great force is often required to unscrew the sections, for the purpose of renewing the boring bit, as may be required several times in the course of a day's work.

STOP FOR SHADE ROLLERS.—G. R. GATON, care of Grigg Shade Roller Co., Coffeyville, Kan. This invention relates to a spring stop for window shades or curtain rollers. An object is to overcome the objectionable features inherent to the old form of spring stops, and to provide a stop of comparatively few parts, and one positive of definite action at all times.

Household Utilities.

DAMPER ATTACHMENT FOR STOVES.—J. F. BIRCH, care of John E. Birch & Sons, Roland, Manitoba, Canada. This invention is applicable particularly to cook stoves, and is embodied in the construction and arrangement of two pivoted dampers, whereby they may be



DAMPER ATTACHMENT FOR STOVES.

operated simultaneously for closing one and opening the other to control the circulation of the products of combustion, whereby they may pass directly to the escape flue or be diverted to pass around the oven.

COOKING STOVE.—J. R. LEONARD, 53 Kimball Bldg., Cedar Rapids, Iowa. The oven is arranged above the firebox and is so constructed that the former is ventilated and the heat evenly distributed throughout. A direct draft is heated to an intense heat before entering the fire from below the firebox, and a secondary draft is heated to an intense heat before being admitted above the bed of the burning fuel.

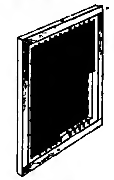
FLY TRAP.—G. CHRISTON, Box 273, Pearl River, N. Y. Among the principal objects which this invention has in view are to provide a device which is economical of construction and simple of operation, and to provide a device having a fixed annular receptacle and

FLY TRAP.

a removable central receptacle of liquid, together with means for readily removing the central receptacle. The operation is based to a large extent upon the known peculiarity that insects rarely will crawl downward over a relatively vertical surface.

CLOTHES PIN HOLDER.—H. B. STEBBINS, R. F. D. No. 2, Oelwein, Iowa. This holder is for use in connection with laundry work, and it comprises a frame having means for holding a plurality of clothes pins ready and available for immediate use and means for supporting the frame from the person of the user.

WINDOW SCREEN.—V. CARANNA, 145 Bleecker St., New York, N. Y. Among the principal objects which the present invention has in view are: to provide means for permitting and for inducing the escape of flies from the rooms provided with the screens, to



WINDOW SCREEN.

provide means for reversing the operative position of the screen, and to provide traps for the capture of flies when passing through the screen. The engraving shows a perspective view of the screen, part of the netting having been removed to show the construction of parts otherwise concealed.

Machines and Mechanical Devices.

DRIVING BELT.—H. U. SMITH, Station B, Route No. 1, Columbus, Ohio. In this instance the invention refers to belt gearing and has particular relation to a driving belt for use in high speed transmission devices and particularly in connection with belt gearing in which there is employed a power pulley of a relatively small diameter.

DUMPING AND CLEANING APPARATUS FOR DIGGING MACHINES.—H. W. SARGENT, Fort Dodge, Iowa. This invention relates to digging machines of the type wherein buckets or scoops are made to fill themselves by being scraped along the surface of the ground to be excavated as the end and sides of a trench or ditch.

VALVE.—J. J. MAYER, 366 Lenox Ave., New York, N. Y. This valve is for use in flushing tanks and similar devices, and is arranged to insure a powerful closing with a view to prevent leakage, to present a different surface of the valve disk to its seat at each operation, to insure its long life and to prolong the period of its repairing or rewashering.

PNEUMATIC PLASTERING MACHINE.—P. L. CROW, 110 Livingston St., Elizabeth, N. J. This invention insures the delivery of a plastic mass, such as plaster, to a distant point, to permit of cleaning the pipe connections, and allows the operator to automatically shut off the supply of the plastic mass, and to signal to the machine operator in case the mass from one supplying chamber is exhausted so that another supplying chamber can be connected up to supply more plastic material and to avoid delay in supplying the mass where needed.

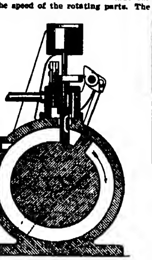
PLATFORM SCALE.—W. H. DRAUGHON, 10 Lack Bldg., Nashville, Tenn. The invention provides means for causing all parts of the platform to move vertically at the same velocity at any point of the [illegible] by that

weighing lever, and reduces wear and friction in the moving parts of said means. The means heretofore employed for the first purpose may be adjusted so as to accomplish the desired result while the weighing lever is occupying a substantially horizontal position, but as the lever passes from this position the imperfection of the means heretofore used is such that, under certain conditions, a perfectly parallel movement of the platform is not maintained.

GEARING.—O D. ALSPACH, Lancaster Ohio. This invention relates to gearing, and has for its object one having wheels with gearing for pulling taut a rope or chain secured to a fence, there being a bearing movable relatively to the wheel in which a gear wheel is journaled for meshing with the first mentioned gearing, so that the first mentioned wheels may be rotated by the said gear wheel when the bearing is in normal position, and the first mentioned wheels may be rotated freely independently of the gear wheel when the bearing is moved away from the first mentioned wheel

Prime Movers and Their Accessories.

ROTARY ENGINE.—J MCRAE, Caryville Fla This invention relates to a rotary engine and particularly to the means for controlling the steam inlet valve and to the means for governing the speed of the rotating parts. The

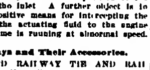


ROTARY ENGINE.

object is to provide an engine having a steam inlet actuated by the relative position of the piston and the inlet A further object is to provide a positive means for intercepting the passage of the actuating fluid to the engine when the same is running at abnormal speed.

Railways and Their Accessories.

COMBINED RAILWAY TIE AND RAIL FASTENER.—H A Basquier St. Croix Falls Wis. In the present patent the invention has reference to a combination steel and wood tie and an improved form of rail clamps, the

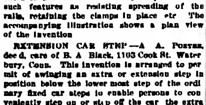


COMBINED RAILWAY TIE AND RAIL FASTENER.

wood members of the tie seating on the hollow steel tie body, and in turn forming seats for the rails. It is the design of the inventor to improve in various particulars the devices indicated to the end that efficiency be promoted in such features as resisting spreading of the rails, retaining the clamps in place etc The accompanying illustration shows a plan view of the invention

EXTENSION CAR STEP—A. A. FOSTER, dec'd, care of B. A Black, 1103 Cook St. Waterbury, Conn. This invention is arranged to permit of swinging an extra or extension step in position below the lower most step of the ordinary fixed car steps to enable persons to conveniently step on or step off the car the extra or extension step when not in use being folded out of the way so as to form no obstruction while the car is in motion

SMOKE PREVENTING DEVICE AND ECONOMIZER FOR LOCOMOTIVES.—E KOHAN, 2046 Madison Ave., New York, N. Y An object here is to provide a novel means for causing a secondary combustion to consume

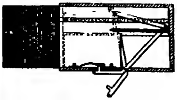


SMOKE PREVENTER AND ECONOMIZER FOR LOCOMOTIVES.

and utilize the heat from the unconsumed particles that pass from the locomotive firebox to the smoke-stack. The inventor takes up the heat from the gases and products when at their highest point of heat, and utilizes the heat thus conserved to aid in producing a secondary combustion in a smoke-pipe The heat developed he utilizes for heating a fluid, preferably atmospheric air and the heated fluid is in turn utilized for any available purpose in connection with a locomotive or train. In a preferred arrangement, he employs the heated air for promoting combustion in the firebox

Pertaining to Vehicles.

SIGN AND INDICATOR—V FICCIO, Tampa, Fla The invention pertains to signs or indicators, especially those adapted to be carried at the rear of automobiles to indicate the direction in which the vehicle is about



INDICATOR FOR DIRECTION OF VEHICLE.

to turn The main object of the improvement is to provide a sign of light weight which may be operated mechanically to project into view a slide bearing a legend or word showing the direction in which the vehicle is about to proceed.

RESILIENT TIRE—R L. JENKINS, 2204 E West Cary St Richmond, Va. An object of this invention is to provide a resilient tire which shall take the place of the pneumatic tire in ordinary use but which can be manufactured for much less cost and which is not subject to the danger of deflation due to punctures or blow-outs

VEHICLE AXLE—J E. HADGAN Winter pock Va This improvement is in axles having detachable journals or spindles and particularly in that class in which the axle ends are slotted and the journals or spindles provided with shanks adapted to fit in such slots. The invention provides a more easily effected and a more secure automatic engagement, and avoids weakening the axle by the construction required to effect such engagement

SPRING TIRE FOR VEHICLE WHEELS—H J CASEY Keeseville N Y An object here is to provide metallic springs for tires to be used as a substitute for pneumatic tubes to which the various members constitute a unit the elements of which are so formed and arranged as to permit of the unit being quickly placed within the ordinary shoe

SPEED GEARING G Q SEAMAN 101 Ralph St Brooklyn N Y The invention provides a speed gearing for automobiles and other vehicles and devices, and is arranged to permit the operator to readily change the speed from a low to a medium or a high speed or to reverse without moving any of the power-transmitting gear wheels out of mesh

Designs.

DESIGN FOR A KITE—H E WILSON care of Johnson & Larimer Dry Goods Co Wichita Kan In this ornamental design the kite simulates the outlines of a garment, with front and side pockets buttons fly trousers legs, etc the whole keeping within the lines of the ordinary kite

DESIGN FOR A PLATE DISH OR SIMILAR ARTICLE—F BOOTE and J B BOOTE 46 W Broadway New York N Y This ornamental design is of a plate or dish of circular form the border comprising a double band of twist design another band of the same encircling near the center a large cluster of flowers Between the outer and central bands flowers are grouped with charming effect

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each Please state the name of the patentee title of the invention, and date of this paper

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents subscriptions books etc This will greatly facilitate answering your questions as in many cases they have to be referred to experts The full name and address should be given on every sheet No attention will be paid to unsigned queries Full hints to correspondents are printed from time to time and will be mailed on request.

(12756) G E S asks I have heard of a method of finding a spring of water Take a limb of a plum tree which has a crotch in it Take the two prongs of the crotch in the hands and hold the limb horizontally Walk along and when you walk over a spring of water the stick will be attracted to the ground Please let me know through your valuable paper what condition of the wood (dry or green) gives best results What size of limb should be used? Can any other kind of wood be used? To what depth can a spring be detected? Is this method successful when the ground is covered with snow? What causes the branch to dip? One person told me that when he heard of it he didn't believe it but the first time he tried it the branch was attracted so that it broke A We must say that we do not know anything about the finding of water by means of a crotched stick nor do we believe it can be done As a boy we lived in the country where wells were depended upon for water and we saw not a few men use the witch hazel stick It was said then that the stick must be of witch hazel You say it should be plum One is doubtless as good as the other We have seen many failures with the sticks and have known men to dig deep where the stick had turned down vigorously without any water being found Sometimes water was found but if there is a divining rod of any value water should always be found when it indicates water with any force We cannot be of any help to you in explaining the divining rod The rods used were usually green freshly cut

(12757) N G asks Would you be kind enough to inform me how to use the figures written as follows 1.3×10^{-6} and others like them with a positive exponent? These numbers are in constant use in works on radio-activity and the higher branches of science A A negative exponent indicates division In the example which you propose it requires that the decimal point be removed six places to the left thus 1.3×10^{-6} = 0.000 001 3 This is as you see thirteen ten millionths If the exponent were positive it would indicate multiplication by 10 thus 1.3×10^{6} = 1 300 000 The decimal point is to be removed six places to the right This is a device to save time in writing and space in printing

(12758) H R R asks 1 What causes the moon to swing back and forth from north to south? Sometimes rising far to the north and again far to the south and are these vibrations regular? A The moon moves in an orbit around the earth which is nearly in the same plane as that of the earth around the sun its orbit being inclined but 5 degrees to the plane of the ecliptic This will cause the moon to change its points of rising and setting along the horizon each month as the sun does through the year only a little more Since the full moon is always opposite the sun in the sky it follows that it will rise farthest to the north of east in the winter when the sun rises farthest to the south of east and *vice versa* in the summer This motion is perfectly regular and is repeated every month but it does not occur at the full of the moon every month and is not usually observed excepting at or near the full of the moon 2 What is the construction of the electric switch used on automobile starters? When it is closed the motor starts the engine and when it is released the motor turning in the same direction becomes a dynamo and charges the accumulator I was always under the impression that a motor turned in one direction and a dynamo in the other A You are correct in your general statement that a motor will run in an opposite direction to that of a dynamo which generates a current of the same polarity For the construction of the particular switch we must refer you to the makers of the switch The makers of the automobile will probably also be able to give you the information you ask 3 What causes the sun to appear to grow larger when it approaches the horizon and become oblong in shape especially when setting behind a thin bank of cloud? A The sun and moon appear larger at their rising and setting because of our comparing them with the objects on the horizon They are immensely more distant and larger and so give us the impression of growing larger How this happens you can see by making this experiment Take three inches on a sheet of white paper Divide it carefully in half Mark off one half into eighths of an inch, by making dots with a pencil and leave the other half in one clear space The space filled with dots will appear the longer although you have made it just equal to the open space. It is an optical illusion of which we cannot rid ourselves 4 Do the fixed stars change their time of rising through a course of years, or do they always rise at the same time? A The stars rise and set every day about four minutes earlier by the clock than they did the day before, and thus they seem to move around the sky every year Notice any bright star for a month, and find that it is farther west by about 30 degrees at the end of the month than it was at the beginning at the same hour of the evening.

NEW BOOKS, ETC.

AN INDUCTIVE CHEMISTRY By Robert H Bradbury, A M, Ph D New York D Appleton & Co, 1912 8vo, 437 pp, illustrated

Prof Bradbury's endeavor has been to produce a textbook that shall stand the test of the student viewpoint Every portion of the book has been tried out again and again in actual class work By regarding each separate subject as a problem by bringing first the everyday knowledge of it into play and by augmenting this knowledge by experiment the interest of the study is kept up and the growing intelligence and knowledge keeps pace with the introduction of new problems. The method and arrangement of the work is good, and satisfactory results will doubtless follow its adoption in class study

SLEEP AND THE SLEEPLESS Simple Rules for Overcoming Insomnia. By Joseph Collins M D New York Sturgis & Walton, 1912 12mo, 120 pp Price $1 net

However much one may believe in the efficacy of counting sheep in occasional cases of sleeplessness it is certain that only a long-continued *regime* of simple worry free living can really cure the old insomniac. Dr Collins who is physician to the Neurological Institute of New York makes no claim to short cuts in the cure of sleeplessness but does embody in his work in easily understandable terms the latest results of scientific study The cause of the malady is first sought the requisite quantity of sleep for the individual is determined and the curative agencies are described Opiates and narcotics hypnotism and suggestion are all duly considered and their advantages and disadvantages weighed in the balance Mental attitude position breathing food and drink exercise—all these influence sleep in a marked degree and no one of them has been neglected in the chapter on treatment

HOW TO READ A DRAWING By Vincent C Getty Philadelphia J B Lippincott Company, 1912 8vo, 64 pp, 62 illustrations Price, $1 net

In a very attractive series of papers Mr Getty comes near to proving his original proposition—that the reading of a drawing is really a very simple accomplishment and that to be able to read and understand common English is all the education necessary to its acquirement He makes a strong plea for the usefulness of the accomplishment justly urging that in the industrial world no work of importance is undertaken without the aid of drawings He has employed as few technical terms as possible has given a sufficient number of actual examples to impart to the text a highly practical value and has in fact succeeded in his purpose to help the man of little education to a thorough knowledge of the reading of mechanical and architectural drawings.

CELLULOID Its Manufacture, Applications, and Substitutes By Masselon Roberts, and Cillard Translated from the French by Herbert H Hodgson, M A, B Sc, Ph D Philadelphia J B Lippincott Company 1912 8vo 356 pp, illustrated Price $7 50

In the absence of any adequate literature on the subject of celluloid and the processes of its manufacture this capable translation from so authoritative a source will doubtless receive a hearty welcome The authors have aimed at a complete and practical work in which processes and their relative values are conscientiously studied and discussed Methods of working materials time required for the various operations consumption of raw materials cost of labor and power and cost of installation all receive attention in the various divisions of the volume Among the objects of manufacture specifically dealt with are combs umbrella handles hollow articles celluloid linen phonographic cylinders, buttons and teeth

INTRODUCTION A L'ETUDE DE LA METALLURGIE Le Chauffage Industriel Par M Henry le Chatelier Angers A Durdin et Co, 1912

This volume as its preface informs us is a reproduction in book form of the lecture course in general metallurgy at the Ecole des Mines The volume comprises two distinct parts. The first devoted to heating discusses successively general phenomena of combustion natural and artificial fuels and furnaces The second part devoted to the study of metals and their alloys, discusses successively the constitution and the properties of iron-alloys and of metals other than iron The high position occupied by the distinguished author of this book is in itself a sufficient guarantee of its excellence The greatest scientists have been the greatest teachers If any evidence were needed to that effect this book would adduce it. On every page one perceives how one of the greatest of living metallurgists has drawn from his ripe experience and presented it in a form which will enable the student to profit by it Although in a scientific text-book which is intended primarily for the use of students, one does not expect to find anything but clearness of exposition Prof Le Chatelier has gone out of his way to present his subject as gracefully as the limited possibilities before him would permit. The result is a book which may be regarded not only as pre-eminently fitted for the use of the student in metallurgy but one which that same student will read with some degree of pleasure.

TRANSACTIONS OF THE AMERICAN CERAMIC SOCIETY Volume XIV Columbus O, Published by the Society, Secretary's Office, 1912.

Salt-rising Bread

(Concluded from page 229.)

ural question. Without a doubt, it is largely a matter of taste The bread is different. With the first bite, one will notice its distinctive odor and flavor, which to many people is decidedly agreeable Its relative digestibility and wholesomeness remains undetermined. It may be truly said, however that it is eaten by many with perfect safety, while yeast bread causes indigestion

This research promises to prove of practical value. Plans are already made by which a leaven, containing the newly-discovered bacillus will be put upon the market for home and bakery use The introduction of this product should eliminate failure and improve the quality of salt rising bread generally

In the meantime if any of my readers' desire to make salt rising bread, they will find the following tried recipe a good one

Recipe for Salt-rising Bread.

Yeast—Take one cupful of sweet milk in a quart cup Place cup upon stove until milk boils well Stir into the boiling hot milk five or six teaspoonfuls of white corn meal to which a pinch of soda has been added. Wrap up well, and set in a warm place overnight, or until it is light

Sponge—Pour one and one fourth cupfuls of water as hot as the hand can bear in a bowl and add about two cupfuls of flour Then add the yeast from the quart cup and stir with a spoon until mixed. Place the bowl in a warm place until the sponge rises well about one to one and one half hours. A good way to keep the sponge warm is to place the bowl in warm water The water should be at body temperature or warmer

Dough—Take one and one fourth cupfuls of hot water (almost boiling) and dissolve in it four teaspoonfuls of sugar one teaspoonful of salt, two teaspoonfuls of lard and add six or seven cupfuls of flour Then add the sponge and mix well Add more flour if necessary to make a rather soft dough Mold the bread into loaves at once Put in a warm place to rise one to one and one half hours and bake in the usual way

Salt rising bread is close grained, and it should not be made as light as other bread

Some readers may be curious to know why this bread is called "salt rising" bread Of course, salt has no leavening power There is no light on this question in literature. The name was probably chosen because the leavening power was not understood, and it was thought that salt in some mysterious way caused the rising

Left Side Steer and Center Control in Motor Cars

(Concluded from page 2?1)

when sitting on the left is no more difficult than judging distance on the left when sitting on the right. In the situations where the most accurate steering usually is needed the chauffeur can see the adjoining wheels of both vehicles concerned, and also the road between them. When the car that is being overtaken is steered from the left the chauffeur is in the best possible position for he can see exactly what the other car is doing and can act accordingly

Undoubtedly there are many peculiar situations where right side steering would have, the advantage over left-side steering, but there are just as many emergencies in which the opposite would be true, so that matters may be said to be balanced so far as extraordinary predicaments are concerned It is in the ordinary, every day phases of motor car driving that left-side steering appears to the best advantage, emergencies must be dealt with as they occur

With the increasing appreciation of the good points of left-side steer has come a realization of the great convenience of centrally located control levers—that is, the gear-shift lever and the emergency brake lever—and the combination of left-side steer and center control is one that

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Inquiry No. 9293 Wanted the names and addresses of manufacturers of waterproof cloth also samples of such cloth

Inquiry No. 9294. Wanted to buy glass balls 1½ x 1¾" in diameter

Inquiry No. 9295. Wanted name and address of some glass manufacturing company who can make patent lamps.

Inquiry No. 9297. Wanted names and addresses of manufacturers of dogs saving household conveniences goods.

is embodied in a number of very well known cars and promises to achieve much greater prominence As center levers usually are arranged, the driver has little or no difficulty in passing them, and so can dismount from the car on either side. If a passenger is beside him he will politely climb out into the road If not, he will alight on the sidewalk The passenger in the front seat is not annoyed by being forced to move every time the chauffeur wants to get out, or by having the chauffeur squeezing past From the chauffeur's point of view there is no particular in convenience in changing from right to left steer with center control, because the right hand, accustomed to handling the levers, still does the work Even when the levers are placed on the left side however, it is not a particularly difficult matter to become accustomed to the new position

With regard to what may be called naturalness of position it is said that a driver who has been accustomed to right side steer has very little difficulty in adjusting himself to the conditions that obtain in steering from the left On the contrary however, drivers who have become thoroughly familiar with the left side position find it decidedly difficult to get used to right side steer and, it is said, never quite overcome a feeling of awkwardness that is not usually felt after a little experience by those who change from right to left.

The Tallest Office Building in the World

(*Concluded from page 227*)

tween the elevator and the envelope is just enough to permit the increasingly compressed air to gradually slow up the car and finally to bring it to a standstill

The falling elevator is substantially a loosely fitting piston but even so, it would be stopped with a violent jar after entering the inclosed shaft if some provision were not made for regulating the initial compression of the confined air. A jar of this sort would be enough to throw the occupants to the floor of the elevator and might easily be the means of breaking their bones if not hurting them more gravely But the air pressure will be controlled by automatic valves. The designer has two other ways of regulating the air pressure which are illustrated herewith

Mr Ellithorpe has already dropped more than three hundred feet without injury and the car has been so gently restrained and halted that water was not spilled from a brimming tumbler In the test in the Woolworth Building Mr Ellithorpe will drop in the car a sheer distance of 530 feet, and in that interval the elevator will attain a maximum velocity of two miles a minute—that fall will be made in less than six seconds, and the remaining 117 feet of confined air will be counted upon to overcome that momentum and to stop the car progressively For the test, the ordinary cables will be detached, and a single rope with a tripper, subject to Mr Ellithorpe's control, will be substituted.

By means of a large number of gages, which will be fitted for the first time in tests of this sort, records will be taken of the air pressures at each stage of the drop within the limits of the air cushion and engineers are much interested in the data which will be obtained in this way

It is interesting to note that as the falling distance is four times the stopping interval, Mr Ellithorpe will, during the latter interval, have his weight increased fourfold. Some time ago, during a test of this sort, the occupant of the car was seated in a chair When his weight was increased by the retardation of the car, the chair was crushed, and the passenger was fatally injured by a splinter

Our thanks are due to Mr Cass Gilbert, the architect, W Gunvald Aus, the structural engineer, and the Thompson-Starrett Company, the contractors, for courtesies rendered during the preparation of this article.

Chemical Balance and the Fire Waste Problem

By Sidney G Koon

WHAT happens when you touch a match to the kindling in your kitchen stove? The simple and obvious answer seems to be— It burns That is true enough so far as it goes but the answer does not even suggest the complicated and far-reaching results that are accounted for by the very simple chemical principle involved in the lighting of a small fire

In a mass of paper and kindling wood we have various forms of carbon The flame of the match heats a portion of this carbon until the carbon combines rapidly with the oxygen of the air that is to say a small part of the kindling burns or oxidizes and from this small start the process of burning or oxidation spreads rapidly to every carbon compound that can be heated by the fire *up to the point* where it will *combine* with oxygen Of course all this is an old story but there may be new morals to old stories and there is a new moral to this story if we look at it from a certain point of view

From this point of view all burnable materials represent a state of unstable equilibrium A big wooden dwelling for instance may feel and look almost as solid and enduring as a mountain yet in point of fact it is made up barring the nails and other hardware of a great mass of carbon compounds that a little push in the shape of a few hundred degrees of heat will completely upset

The upsetting is not quite so instantaneous as the fall of a vase which you may knock off the table with your elbow but once give that heat push in the right place and the overturning of the carbon mass that we have been calling a house may be very rapid indeed Moved by this initial heat-push the carbon in the floors the wood finish the clapboards the roof the framing the outside paint and the inside furnishings all rush into combination with the oxygen of the air and what was a house carpets tables and chairs curtains becomes suddenly a rising whirlwind of carbon oxide and carbon dioxide it goes up in smoke and heat

This conception of every burnable substance as being in such a state of balance that a small push at some appropriate time will upset and destroy that substance is of more practical value than may appear at first sight It is perfectly true of course that many houses have for scores and some even for hundreds of years survived the upsetting chances of human carelessness while every day others get the little heat push at the proper moment and in consequence are overturned and destroyed

The more interesting field for the application of this idea is the vast number of large buildings for manufacturing or for office use whose size greatly increases the possible magnitude of a chemical overturning due to the heat push and whose occupation by a large number of human beings gives to such chemical upsetting something more than a merely scientific interest If we apply the idea carefully and logically we shall find that this notion of a chemical balance which may be suddenly and completely overturned by a relatively small application of a few hundred degrees of heat is a pretty comprehensive and at the same time a fairly exact guide in the matter of preventing the start of serious fires and of limiting the extent of the chemical overturn after it has once got under way

Naturally the first lesson is that this chemical overturn will not affect substances whose carbon is in such shape that it will not combine when heated with the oxygen of the air This suggests right away the use of stone, brick, terra cotta and cement for building materials, and so far as the oxidation overturn is concerned the materials named are satisfactory, or perhaps it would be better to say that they were combined in buildings only so far as they are capable of furnishing the strength required for a particular building

When we consider steel-frame buildings we meet an apparent contradiction, for though everyone knows that the steel in a building frame does not burn when the building burns, it is also [illegible]

ELECTRONS AND THE ELECTRONIC THEORY are discussed by Sir Oliver Lodge in Scientific American Supplements 1428, 1429, 1430, 1431, 1432, 1433, 1434. Price 10 cents each. For sale by Munn & Co., Inc., and all newsdealers.

edge that an unprotected steel frame will bend and collapse when it is heated red-hot. This bending of steel frames under heat is not a loss of chemical balance, but is mechanical. The steel when heated loses its stiffness, but remains chemically unchanged. This loss of mechanical balance is guarded against by covering the steel framework with substances that will protect it from heat—commonly brick, tile or cement. Even wood will serve for a time, for although the wood casing will finally burn off if the fire continues long enough, it will prevent, until it does burn off, that heating of the steel frame that destroys the rigidity of the steel and causes collapse of the building.

It should be noted, however, that the failing of steel or iron framework in a fire is merely mechanical, and that steel is thoroughly effective as a fire resistant when it does not have to support a load. We see this use of steel or iron in the tin-covered doors that have been used in factories for many years past. The metal covering of such doors (which are wood inside) may become red hot, but it does not give out because there is no mechanical strain on it. In other words, it preserves its chemical balance, and has no mechanical balance to worry about.

In trying to build a fire-proof structure it is necessary first to protect the chemical balance of the structure by using non-burnable materials, and if the structure has a steel frame, as most large modern buildings do have, to safeguard the mechanical equilibrium of the frame by protecting the frame from severe heating that would cause it to collapse. But there is in every large building a new problem due to the size of the structure and to the amount of burnable material that may be gathered in one apartment—or compartment—of the building.

In this respect there are really two problems looking merely to the safety of the building as a structure. One problem is to reduce the amount of combustible material to so small a heating power that it cannot overcome the heat protection given to the steel frame. The other problem, which arises mainly in office and apartment buildings having many separate compartments or rooms, is to build each compartment so that a chemical overturning—or fire—starting therein may be confined to that section or unit.

Generally speaking, a fire in one room or one suite of rooms in a large building will not endanger the stability of the structure itself, provided the fire can be restricted to the compartment in which it starts. Or to recur to our first idea, the heat-push due to the combustion of the contents of one room will not upset the balance of the whole structure if the push can be kept localized. If we take for an example a large office building, it is plain that the stairwells and elevator shafts become, in the event of fire, chimneys which develop an enormously powerful draft and which speed a fire to all parts of the building above the level where the fire originates. The danger to human life from this spreading of fire and smoke in an office building is the first and most serious disaster to be avoided under all circumstances.

A fire spreading by elevator shafts and stair-wells represents a magnifying of the disturbing heat-push generated in the room where the fire begins. Obviously the first step to be taken is to localize the initial push by confining the fire to the rooms where it begins, behind non-combustible doors. The next step is to limit the energy of the heat-push within the room itself, and here the same principles apply that are absolutely necessary in the efficient protection of the larger unit of the whole building.

Assuming that the particular room or series of rooms is shut off from the main passages of the building by non-burnable doors, the next step is to apply within each room the rule that everything possible shall be made of non-combustible material. This is simply the unit system of fire protection with the protection carried into subdivisions of units. The procedure applies not only to the interior finish of the room, but to the furnishings of the room.

EPICYCLIC TRAINS, which play an important part in toothed gearing, are ably described in Scientific American Supplement 1524. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

PORTLAND CEMENT MAKING is described in excellent articles contained in Scientific American Supplements 1433, 1465, 1466, 1510, 1511. Price 10 cents each. For sale by Munn & Co., Inc., and all newsdealers.

SIXTY-NINTH YEAR

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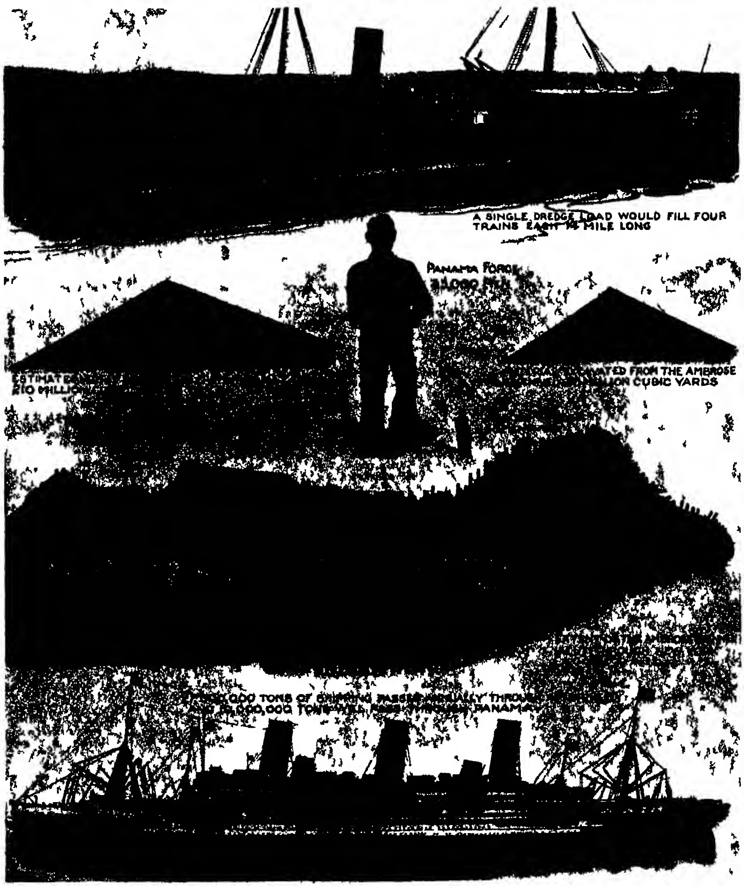

The Ambrose channel is one third the size of the Panama Canal t has been excavated with one bu ir d an l ff f t e numb r f ue i s now a n a in far more shipping than will the Panama Canal in many years t cme

THE AMBROSE CHANNEL AS MEASURED BY THE PANAMA CANAL.—[See page 242]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement

The Minority Views on the Oldfield Bill

In their excellently written report on the Oldfield Bill six of fourteen members of the House Committee on Patents have expressed their minority views on the folly of introducing compulsory licenses and of extinguishing the right of a patentee to treat license violations as patent infringements. Not only are the defects to which we have previously called attention mercilessly exposed, but others are revealed which show how hastily and how recklessly the Oldfield Bill was framed to cure 'evils' which do not exist.

In the proposed introduction of compulsory license and in the limitations intended to prevent the patentee from fixing the price at which his invention may be sold or from prescribing the manner of its use, the minority members see nothing but danger. Compulsory working clauses are to be found in many of the European statutes. Not only are the European industrial conditions different from ours, but it seems to be the consensus of opinion that the compulsory working clauses of foreign countries have not been a success and have discouraged the investment of capital in industries based on patents. If Representative Oldfield's bill were enacted into law, American inventors would be deprived of their present stimulus and would find it difficult to enlist financial support.

Even if the compulsory license principle could be successfully grafted on our patent system, the minority members of the Committee point out how impossible it would be to carry out Representative Oldfield's provisions and still do justice. So carelessly has the bill been framed that it contains no provisions to permit the intervention of a licensee in an action brought to compel the granting of a license. Hence a licensee might be kept in complete ignorance of a proceeding in the outcome of which he is vitally interested.

Equally reprehensible is the failure to deal with the situation arising from fractional or undivided interests in patent rights. The minority members point out that a patent may sometimes stand in the name of several owners. Is it sufficient to serve any one of them? Is it sufficient to pay royalties to one alone? If not, how are the other owners to be brought in and made parties?

The loose manner in which the words "patented invention" are used in the Oldfield Bill is severely criticised, and the results of the necessary construction, which a court would be compelled to place upon them, are tellingly set forth. Theoretically every claim in a patent covers a distinct invention. In a patent containing fifty claims, twenty-five may cover inventions not actually embodied in the commercial product. Since every claim embodies a patented invention, unlimited opportunities for engaging in compulsory license litigation are thus presented. This construction of the words "patented invention," however fantastic and far fetched it may seem, is obligatory. If it were not adopted the minority members fear that it would be possible to draw a patent with a hundred claims of which only one might be worked and ninety-nine with held in flagrant evasion of the provisions for compulsory license.

According to Representative Oldfield and those who side with him an invention is suppressed if it is not adequately used. What is adequate use? In a previous issue we reviewed in these columns some of the difficulties encountered in interpreting the English statute containing a similar expression. The minority members point out still other difficulties. It is hard enough in an ordinary infringement suit to determine whether or not the defendant has used the complainant's invention. The same issues would be presented in compulsory license proceedings. In other words, an application for a compulsory license involves a consideration of a patent's validity and scope, of questions that inevitably arise in every infringement suit.

Let it not be supposed that the Oldfield Bill regards the mere non-use of a patent as a sufficient ground for the granting of a compulsory license. As the minority members of the Committee show, the right of the applicant for a license is dependent upon his demonstrating that the patented invention is being withheld or suppressed for the purpose or with the result of preventing others from competing with articles made by the patentee. "This plainly is an invitation to the easy circumvention of the law by the simple expedient of assigning the patent which it is desired to suppress to someone not engaged in producing any article in competition with the patented invention."

Was it oversight or simply a drastic discrimination against the patentee that induced those responsible for the Oldfield Bill to omit any provision which compels the applicant to accept a compulsory license and pay the royalties prescribed? An enemy of corporations, on reading the bill, would conclude that some industrial octopus stands behind Oldfield. How else could he explain the circumstance that those who can bear the cost of litigation will be enabled to apply indiscriminately for licenses and to accept only those which they may get on exceptionally good terms, with the privilege of abandoning the others after having put the defendant owners to heavy expense in establishing the value of their patents? The minority members fear that the entire assets of a small firm might easily be consumed in defending such a proceeding brought by a powerful corporation.

The amendment of the original Oldfield Bill so as to bring the patent monopoly within the Sherman Law is not approved by the minority. Framed as it was in executive session, without any public hearings to ascertain the views of inventors and manufacturers, the minority members feel that it cannot be seriously considered. That the Sherman Law is amply able to prevent the misuse of the patent monopoly, the minority prove by critically considering some of the decisions handed down in causes that involved an apparent conflict between the Sherman Law and the Patent Statutes. These decisions indicate that when there is no question of the right of excluding others from using or selling an invention in the manner prescribed by the patent law, the Sherman Act applies to patentees as well as to all monopolists. Moreover, the very recent decision in the Bathtub Case demonstrated that the owners of patents are not exempt from the sweeping provisions of the Sherman anti-trust act against monopolistic combinations, and that there is no such inherent natural distinction between owners of patents and owners of unpatented staple products as to justify the application of the Sherman Law to the one class and not to the other. In a word, the proposed Oldfield recodification of our patent statutes is a brilliantly unnecessary piece of legislation, which has needlessly worried manufacturers and alarmed every business man who deals in patented articles.

Sir William White

While most of us wander in life's by ways, exerting but a vanishingly small influence on the progress of human affairs, into the lives of others is crowded such a wealth of events and activities that the task accomplished seems, to the looker on, almost superhuman. In a space of sixteen years, from 1885 to 1902, William White, who has just passed from among us, designed two hundred and fifty warships. This was but one period in a life abounding with activity. A biography of the Father of the Modern Battleship appeared in our columns only a few months ago. The reader will remember that William White, born on February 2nd, 1845, began his apprenticeship in the Royal Dockyard at Devonport at the age of fourteen, and after eight years training in the practice and science of shipbuilding, entered, in 1867 the service of the constructive department of the British Admiralty. In 1870 he became secretary of the council of construction appointed on the retirement of Sir Edward Reed, chief constructor of the Royal Navy—a post later occupied by William White himself. During these years, in addition to his connection with the Admiralty, he also held the chair of naval architecture at the Royal Naval College, Greenwich. Among his students was Admiral Bowles, who later became Chief Constructor of our Navy. To this phase of Sir William White's activity must be reckoned also the publication of the well known 'Manual of Naval Architecture.'

In 1882 William White accepted an offer from the firm of Armstrong, Mitchell & Co. and became director of their new warship building department at Newcastle-on-Tyne. He held this post for three years, during which he superintended the construction of a new shipyard at Newcastle, and constructed warships for Japan, Italy, Austria, Spain, China, and the British Admiralty. The total value of the contracts secured within these three years was about eight million dollars. During this period the Secretary of the United States Navy purchased two cruiser designs prepared by William White, and from these the "Charleston" and "Baltimore" were built.

In October, 1885, William White was appointed Director of Naval Construction and Assistant Controller of the Royal Navy. Here he continued till 1902, when failing health compelled a rest from his arduous tasks—at the age of fifty-seven he retired from government service. Two years later he was able once more to resume active work as consulting naval architect for the Cunard liner "Mauretania."

That a man of the character of Sir William White should have taken an active part in the affairs of engineering societies and institutions is a matter of course. Many were the honors bestowed upon him—the knighthood in 1895, and the fellowship in the Royal Society in 1888 alone shall be mentioned here. But the most appropriate monument to a great man is a grateful appreciation of his work, and in this the memory of Sir William White shall not be found wanting.

The Scientific American Supplement

The Scientific American Supplement was founded in 1876 for the primary purpose of describing and illustrating the more important exhibits displayed at the Philadelphia International Exposition of that year. After the Exposition had closed, it was found that the Supplement had earned for itself so great a prestige that it seemed unwise to suppress it. Accordingly, its publication was continued, and it was made a real Supplement to the Scientific American in every sense of the word. While the Scientific American has always been primarily a newspaper in which the important scientific discoveries, engineering improvements and inventions of the day were promptly and briefly discussed, the Supplement was reserved for the publication of highly important technical papers, read before learned scientific societies, and the translations from foreign publications of articles otherwise inaccessible to Americans.

The amount and character of the material thus printed is remarkable. Practically every field of science, both pure and applied, is represented. The articles themselves are penned, for the most part by the most conspicuous investigators in their respective fields. Indeed, the best scientific thought of the day has always been concentrated in the pages of the Scientific American Supplement in papers written by the most eminent chemists, engineers, physicists, physicians, biologists, and natural scientists. In that respect the publication stands probably unique among all periodicals. We would like to introduce and make thoroughly familiar to our readers some of the authors whose names appear at the head of the articles published in the Supplement, but the list is so long that space does not permit to give more than a brief selection. We see there the names of George Westinghouse, Mr. Logan Waller Page, Prof. W. D. Bancroft, Dr. Baekeland, Prof. Bernthsen, Prof. Wilhelm Ostwald, Prof. Fleming, Sir Oliver Lodge, Sir J. J. Thomson, Prof. Leonard Hill, Sir William White, Sir Robert Hadfield, and many others noted for the important share which they have had in advancing the world's knowledge and power over natural forces.

Since the papers of such distinguished men have more than an evanescent value, a printed catalogue of Scientific American Supplement articles is published from time to time, which is distributed gratuitously and which indexes some ten thousand subjects that have been discussed from all angles. A complete file of past issues of the Supplement, extending back to the year of its inception, thirty-seven years ago, is kept in stock, and copies can be supplied at any time at the published price. These files, together with the catalogue, form an unparalleled reference library within the reach of all at a nominal cost. So far as we are aware, no other scientific periodical has attempted and executed such a feat as this.

The Scientific American Supplement is supported by its subscribers. It contains no paid advertising, in which respect it again stands unique among scientific periodicals.

An "Eiffel Tower" in Buenos Aires.—Application has been made to the municipality of Buenos Aires for a 60-year concession to erect on public property the "Torre Rivadavia," similar to the Eiffel Tower in Paris. It is to be 1,067 feet high, topped by a 106-foot statue bearing a light of 1,000,000 candle-power, making the total height 1,173 feet (Eiffel, 984 feet). It is to be equipped with a wireless station, a meteorological observatory, and an immense electrical clock.

Engineering

A Fatal Sawdust Explosion.—The falling of a bolt among the cutters on a machine for grinding sawdust in a box factory at Philadelphia is stated to have caused a shower of sparks which ignited the finely divided dust and caused an explosion which injured six employees and killed one. Explosions of this character are common in coal mines and they have occasionally occurred in flour mills and other industrial establishments where inflammable dust is generated.

Curious Drydock Disaster.—During a gale a drydock at Spotstown Glasgow, was suddenly flooded by the onrush of water past the caisson gate, three of the workmen in the dock being drowned. The ship was moved from the keel blocks and she was filled with water, some of her plates being off at the time of the accident. An abnormally high tide caused the caisson to lift from its seat. A similar accident happened in one of the drydocks at the Brooklyn Navy Yard many years ago, when the caisson gate, not having been sufficiently ballasted, lifted during a high tide, the water rushing in and damaging two torpedo boats that were in the dock.

The Ingots to Blame.—At last the metallurgists, steel makers and rail users of the world are becoming thoroughly awake to the fact that the original seat of the defects which result in broken rails is the ingot. Hunt, Talbott, Hadfield and many other eminent authorities have recently shown that we cannot be sure of the quality of rails unless we are assured of the quality of the ingots. The latest paper to this effect is one by Bradley Stoughton. Our rail manufacturers are beginning to realise that they must concentrate their attention increasingly upon the furnace practice, and especially upon the ingot, if they are to turn out a reliable product.

In Touch by Wireless Across the Atlantic.—We are informed by the Hydrographic Office in New York that recently the steamship "Barbarossa" was in daily touch with the Hydrographic Office in this city by wireless throughout the whole of her voyage to the eastward across the Atlantic. Communication was maintained up to a distance of 800 miles by radio with the shore station of the Atlantic coast, when the "Barbarossa" came in touch with Crookhaven, Ireland, and the messages were transmitted back by cable. The office has arranged to keep a record of the positions of ships transmitted by radio, and the location of ice and derelicts is being sent direct to the Hydrographic Office in Europe for transmission to ships starting on the westward passage.

Vast Increase of British Navy.—According to recent dispatches the programme for the increase of the British navy this year calls for five or six battleships, the number depending upon the Austrian naval programme. The programme at present calls for five battleships, six armored cruisers, twenty destroyers, several submarines and an addition of 5,000 men to the personnel, making a total of 142,500 officers and men. The cost of this programme will be $240,000,000. The battleships will be of large size, probably 28,000 tons, and it is said they will carry either eight 16-inch guns, each firing a 2,200-pound shell, or a larger number of 15-inch guns firing an 1,800-pound shell. We think that ten 15-inch guns will be the probable armament.

Bids for Building the "Pennsylvania."—Of the three best bids for the construction of our latest battleship the "Pennsylvania"—the largest ship authorized or under construction—made by the Newport News, the New York Shipbuilding and the Fore River companies, that of the Newport News yard of $7,255,000 was the lowest, and the contract has gone to that firm. The total cost of the ship when complete with guns, armor and equipment will be $14,173,000. The "Pennsylvania" was described in a recent issue, in which her dimensions were given as 600 feet between perpendiculars, 625 feet over all, beam 97 feet, and draught 29 feet. The maximum full-load displacement will be 32,500 tons. She will be the largest, best protected and most powerful ship afloat on the day of her launch.

Steel Trains on the New Haven Road.—The two five-hour expresses daily between New York and Boston over the New York, New Haven and Hartford R.R., are now made up of new all-steel Pullmans. These cars embody heavy cast steel U-shaped ends, forming the vestibules, connected by two heavy steel girders which make it well-nigh impossible for the cars to buckle or telescope. Each train consists of four parlor cars, a combination parlor and baggage car, a diner, and an observation smoker at the rear. The drawing-room has been dispensed with in the parlor cars. The ivory-white ceilings reflect the upwardly-thrown rays from ten 100-watt tungsten lamps, each of which is in a lacquered bronze bowl reflector. Each car has two sets of storage batteries connected in multiple, which provide enough current to run the lights when stops are being made at stations, and even for ten hours independently of the charging dynamo driven by a belt from the car axle. The Garland system of ventilation does away with all drafts. This system provides for the entrance of fresh air at the front of each car and the discharge of used air through ventilators in the deck sashes of the roof.

Electricity

Dr. Acheson Honored by the Czar.—The insignia and sash of the Order of St. Anne have been presented to Dr. Edward G. Acheson by the Czar of Russia. Dr. Acheson visited Russia to address the Russian Imperial Technological Institute in order to explain the nature and use of deflocculated graphite. The order of St. Anne is one of the highest honors that can be conferred in the Russian Empire and carries with it nobility to the recipient. Dr. Acheson is now listed as a noble of the Russian Empire.

Transformers in the Lamp Sockets.—The new German method of using a miniature transformer in each lamp socket has the advantage of allowing the use of a low-voltage metallic filament lamp, for instance a 14-volt lamp, and such filaments are much stouter than the usual kind. It is also claimed that the low-volt lamp is more economical in its use of current, and besides, the lamp is from 50 to 70 per cent cheaper to make than the others. Low candle-power lamps from 3 candle-power up can now be made with thick filaments, when using 14 volts. The usual 16 candle-power lamp has two filaments side by side, so that one can break and the other holds good. Each lamp has a small transformer fitted into the socket, and the key turns off the primary coil of the transformer, so that there is no leakage current.

Making Nickel Tubes Electrolytically.—Nickel tubes and other objects are made by the new Ed. Levi process, as it allows of obtaining a thick deposit of nickel in a special plating bath. An acid solution of nickel sulphate is used, preferably as a hot bath. Nickel anodes are employed and the voltage between electrodes should not exceed 3 volts. The density of current is 2 to 3 amperes per square decimeter of surface, and even more, as it is preferable to use a high-current density in this process. A very acid bath at 10 or 15 degrees B. is recommended. The nickel thus obtained is very even and can be plated in a thick layer. Nickel is deposited in this way on an aluminum form, then the form is separated by dissolving in caustic potash or by melting. A tube is best for this form. Thus the nickel is left in the shape of a tube, and the metal is said to be very tough and malleable.

Electricity from Peat.—In a paper read before the Mechanical Engineers Society, M. Bartel brings out some ideas in the way of utilizing the great natural resources which North Germany has in the shape of extensive peat fields, so that this can be used for a good part of the steam power needed for central stations. To keep pace with coming needs in this region there will have to be erected a number of electric plants giving a total of 10,000,000 horse-power, counting 8,000,000 for the use of railroads alone. As this part of the country has but little hydraulic power, steam will be needed and peat fuel is recommended by the author. In this way the great marshes or bogs would be dried up so as to leave a large amount of land for agriculture and the like. In fact he calculates that North Germany contains enough peat to supply all the current needed in this region for as much as 250 years to come.

Electroculture by High-tension Discharge System.—A recent issue of a German electrical paper reports some successful experiments at Petrovic (near Prague) in stimulating the growth of vegetables by high-tension discharges from a network of steel wires stretched across the field at a height of twelve feet above the ground. High-frequency electrical energy was transformed up to 100,000 volts and then rectified for delivery to the network. The total power consumption for the ninety acres constituting the "plant" was two amperes at 120 volts. By turning on the current for a few hours each day—except during wet weather, and during very hot weather when the discharge treatment is useless or even injurious—the quality as well as the yield of the crops was much improved. It was concluded that a similar plant designed to take a large output of electrical energy would pay for itself during the first year of operation.

Flame Detector of Hertzian Waves.—It is found by the German scientist Leithauser that a flame will act as a detector for wireless waves. At the sending end is an induction coil giving a 0.2-inch spark and an antenna wire 5 feet long, and at the receiving end placed about 60 feet off there is mounted an antenna which connects to one electrode placed within the flame of a Bunsen burner, the second electrode being connected to ground. The first electrode consists of a platinum capsule containing carbonate of potash, and the flame keeps it at a red heat so as to melt the salt. The other electrode is a 0.04-inch copper wire placed horizontally at about 0.1 or 0.15 inch from the first. Wires lead from each to a telephone, or in other cases a galvanometer. At each wave signal sent out, there is heard a sound in the telephone. The current set up in the telephone seems to be caused by the flame acting as a current rectifier. Potash salts appear to give the best results, and both electrodes must be kept at a red heat, however a difference of temperature is needed between them, and it should be noted that the direction of the current given off by the flame combination which appears to work as a battery, depends on which of the metal pieces has the higher temperature.

Science

The Death of Lieut. Francis L. Harris.—The last survivor of the Hayes arctic expedition which went forth in search of Franklin in 1860, died in Boston in the 80th year of his age recently. He was Lieut. Francis L. Harris. Although it stayed in the Arctic about two years and suffered great hardship, the expedition did not find Franklin. After the return of the expedition Lieut. Harris enlisted in the Union Navy and fought throughout the war.

The Death of Dr. P. H. Hiss, Jr.—Dr. Philip Hanson Hiss, Jr., professor of bacteriology in the College of Physicians and Surgeons of Columbia University, died recently in New York city, after a long illness. Although only forty-five years of age Dr. Hiss had made a reputation for himself chiefly for his method of differentiating typhoid and colon bacilli, his method of isolating typhoid bacilli, his studies of the bacteriology of typhoid fever, his determinations of the relation of serum globulin and diphtheritic antitoxin, and his differentiation of pneumococcus and streptococcus and capsule staining methods. His recognition of dysentery, typhoid and allied bacilli, his researches on the bacilli of the dysentery group, and his study of the curative influence of extracts of leucocytes upon infections also deserve mention.

Water Hardness and Health.—Hardness of water, that is the amount of lime or other salts which it contains, appears to have a direct influence upon the health as the researches of Dr. H. Roemer of Berlin bring out. Dentition is much influenced, as observed in the case of school children, and examining several thousand he finds that the percentage of persons having entirely sound teeth varies from 1.3 up to 20.2 per cent, according to the degree of hardness of the water in various localities. Hard water containing lime acts favorably in this case and magnesia appears to harden the enamel. The number of young men adapted for military service also increases in regions having hard water. As to action on the blood, lime and magnesia act by their alkaline properties to strengthen the growth of children. According to this he states that soft water should be used for washing and cooking and hard water for drinking purposes.

The Turkey Buzzard and the Hummingbird in the House of Representatives.—On February 8th Mr. Akin of New York submitted the following resolution in the House of Representatives which resolution was referred to the Committee on Agriculture and ordered to be printed:

Resolved, That the Secretary of Agriculture be, and he is hereby, authorized and directed to expend not exceeding $1,000 in the purchase of six high-grade thoroughbred male turkey buzzards and ninety-nine thoroughbred humming birds, each to be examined and passed upon by Dr. A. D. Melvin, Chief of the Bureau of Animal Industry, as to soundness of limb and heart strength, in order that a test may be made as to the value of the offspring, be they gnats or fleas, for agricultural purposes, and to report to Congress whether the experiment is more valuable to the American farmer than the one now going on in this bureau where thousands of dollars have been expended in buying zebras in Africa and transporting the same to the District of Columbia, where they are joined in wedlock to Missouri mules, the offspring of which seem to be a cross between a North Dakota jack rabbit and an Australian kangaroo; and the sum of $1,000, or so much thereof as may be necessary, is hereby appropriated out of the contingent fund of the House to carry out the purposes of this resolution.

Those responsible for the printing of this absurd resolution ought to take a course in the correct appreciation of jokes.

Detroit Observatory of the University of Michigan has just issued the first installment of its "Publications," including an historical sketch of the institution by its present director, Prof. W. J. Hussey. It is, in several respects, among the most interesting observatories in America. It was built in 1854 with money raised by citizens of Detroit, whence its misleading name. (It is situated at Ann Arbor.) It was equipped at the outset with a 12¼-inch refractor by Fitz of New York, still in use—which was, when built, the third largest refractor in the world, and the first large telescope constructed entirely in the United States. The observatory is almost unrivaled among American institutions in the number of distinguished astronomers who have been connected with it, as directors, members of the staff or students. A picturesque chapter in the history of the observatory relates to the discovery of 22 minor planets, between the years 1863 and 1877, by Prof. Watson. One of these, Aethra, has been lost, no observations of it having been obtained since those made at the time of its discovery in 1873, which were not sufficient for a satisfactory determination of its orbit. "The planets discovered by Watson are endowed," the discoverer left a sum of money with the National Academy of Sciences to be used in preparing and publishing tables for these bodies, and the first installment appeared in 1910. Since 1911 the director of Detroit Observatory has also been director of the Observatory of La Plata, in Argentina, dividing his time between the two institutions. What with the observatory's misplaced name, Watson's "endowed planets, and Hussey's shuttling between antipodean institutions, the history of Detroit Observatory has certainly been tinged with bizarrerie.

The Curtiss Military Biplane

Description of the New Curtiss Tractor Aeroplane for Army Use

By Stanley Yale Beach

THE new Curtiss biplane illustrated herewith has been produced in fulfillment of the specifications for army aeroplanes issued by the Government early this year. These requirements have been published in the SUPPLEMENT No. 1940 and a résumé of them was given in our last issue. The chief requirements are that the machine must carry a load of some 600 pounds during a 4-hour flight; that it must rise at the rate of 200 feet a minute and that it must have a maximum speed not exceeding 65 miles an hour.

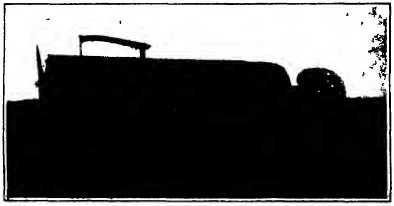
To fulfill these requirements Curtiss has produced a rather large biplane having a spread of 37 feet 4 inches for the upper plane and a total over all width of 38 feet 4 inches as against a length of 24 feet. The chord of each plane is 61 inches and their spacing apart 60. The weight of the machine complete is 1,050 pounds.

As will be noticed from the photographs this new machine is radically different from the former Curtiss military biplane. The use of a covered fuselage is in partial fulfillment of the army requirements, and this, together with the placing of the power plant and propeller in front follows European practice. The complete covering of the fuselage to reduce head resistance and the arranging of the radiator and motor in front, with a bonnet similar to that used on automobiles is distinctly novel as regards a Curtiss machine. The wings are made up each in one piece instead of in sections as heretofore and they are so set that their front and rear edges form a slight dihedral angle extending backward from front to rear. This form tends to give the machine a certain degree of inherent fore-and-aft stability. The unit construction of each wing and the method of fitting the tail, rudder, etc., make it possible to take apart the machine or put it together again in less than half an hour. One of our illustrations shows the four wings placed beside the body when the machine is to be towed over the road.

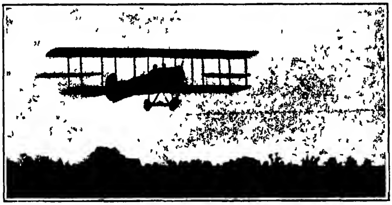
The three-wheeled chassis has a maximum width of 65 inches reduced to 42 inches at the fuselage while the tread is 56 inches. The body is wide enough for two men to be seated in it comfortably and there is a panel removable from the lower plane on each side of the body to allow the occupants to look directly downward if they so desire.

Each aviator has a separate control wheel so that either man or both together can drive the machine. A 40-gallon gasoline tank is placed under the seats, but for running the aeroplane a small 2-gallon tank on the dashboard is kept filled by means of a pump driven from the engine. A glass plate in the face of this tank makes it possible to see at all times the amount of gasoline in the tank and whether or not the pump is working. Should the supply from the main tank cease by throwing a small lever and giving a few strokes of a hand air pump the gasoline will flow from the main tank by means of air pressure developed therein. Another convenience is the carrying off of the oil and smoke from the engine below the body by means of pipes. The up-curved dash in front of the aviators directs the blast of air from the propeller above their heads, also. Although this is the largest machine thus far built by Curtiss, it can be knocked down and packed in three small boxes in short order. To collapse any of the four wings completely so that they will fill a space but six inches wide it is only necessary to remove four bolts.

The new method of wiring and bracing used in the fuselage does not require any holes to be plugged in the main longitudinals, which are made of white spruce and which taper from the front to the rear. The body is so light that it supports itself a light skid being placed under the tail for protection only in making a bad landing. The head resistance of this machine has been reduced so that the machine is as fast as any of the lighter bodyless types now used by the army. It is therefore a distinct advance as far as American military aeroplanes are concerned.



Machine with wings placed beside the body for towing over the road.



Front view of the new tractor biplane in flight, showing comfortable seating of the aviators.

Side view of the latest Curtiss military biplane.

Note dihedral angle of wings as viewed from above, the ailerons, the three-bladed propeller, covered fuselage and fan tail.

A Canadian Arctic Expedition

VILHJALMUR STEFANSSON, well known for his explorations along the Arctic shores of British America and for his discovery of blond Eskimos, has for some time been planning an expedition to seek for new lands in the vast unexplored region lying to the north of the Beaufort Sea and the Parry Archipelago. He recently secured the financial backing of the American Museum of Natural History, the National Geographic Society, and the Harvard Travelers' Club; but shortly afterward was invited by the Canadian government to undertake the journey under its auspices and at its expense. He has accordingly been released by the three American societies and the expedition will sail under the British flag. Stefansson is a Canadian by birth, but was educated in the United States.

The expedition is expected to sail from Esquimault, B. C., the latter part of May on the whaler "Karluk," just purchased for this purpose, and to spend about three and a half years in the Arctic. Dr. R. M. Anderson is to be second in command, and the scientific staff will probably consist chiefly of Canadians. The region to be explored is the largest stretch of completely unknown sea or land in the northern hemisphere. Certain peculiarities of the tides seem to indicate that it contains extensive land areas. On the eastern border of this region is the supposed location of Crocker Land, which was sighted by Peary on his journey to the pole, and is to be sought by Macmillan's forthcoming "Crocker Land Expedition." It should also be noted that Amundsen's projected drift across the North Polar Basin will probably carry him into this unknown area.

Stefansson hopes to land at Prince Patrick Island next September and establish his main base at Land's End. The ship is to leave him here, return to civilization and thereafter to make yearly visits to the base. Of course any such programme is liable to be more or less modified by ice conditions. From Land's End the party expects to make sledging journeys in various directions over as much as possible of the million square miles that are now a blank on the map.

The expedition will be equipped with a powerful wireless telegraph outfit, and it is hoped that the base station will thus be kept in constant communication with the world. This ought not to be difficult since the Canadian government is now establishing a chain of wireless stations in the far north of British America, including one at Herschell Island, at the mouth of the Mackenzie River. It is also proposed to carry a wireless outfit on the sledge in order to keep the explorers in touch with their base. A moving picture machine is to be included in the equipment of the expedition.

Court Decides Against the Taggart Dental Inlay Patent

MUCH interest is taken by dentists in the decision of the Court of Appeals of the District of Columbia voiding the Taggart patent, No. 872,978 of December 3rd, 1907, upon a divisional application filed July 12th, 1907, of original application filed January 12th, 1907. This decision, the opinion in which was rendered by Mr. Justice Robb, reverses the decision of the Supreme Court of the District of Columbia, which decision sustained the Taggart patent. Defense was made that the invention had prior to Dr. Taggart's invention been taught, used and operated, at least two years before the filing of the Taggart application for patent. The Court said that it was fully persuaded that the evidence shows beyond a reasonable doubt that for many years prior to the filing of the application for patent the process of making patterns and molds for dental inlays and the like, as expressed in the claims, had been publicly practised upon many occasions, and that it was of no possible consequence that by the use of Dr. Taggart's machine, gold inlays and the like might be produced more cheaply and rapidly than they were produced by dentists who had testified in the case. The Court goes on to say that the art of producing metal castings by means of a mold formed of a wax pattern is very old, was practised by the ancient Greeks and Romans, extensively used in the middle ages for producing statuary, and is known as the *Cire perdu* or "lost wax" process.

A Chair of Sericulture has been created in the scientific department of the University of Lyon, France, as a part of the general instruction in applied sociology. Funds for the payment of a professor and an assistant have been raised by the local chamber of commerce, as one means toward maintaining the supremacy of Lyon in the silk industries of Europe.

The Growth of a Great Navy

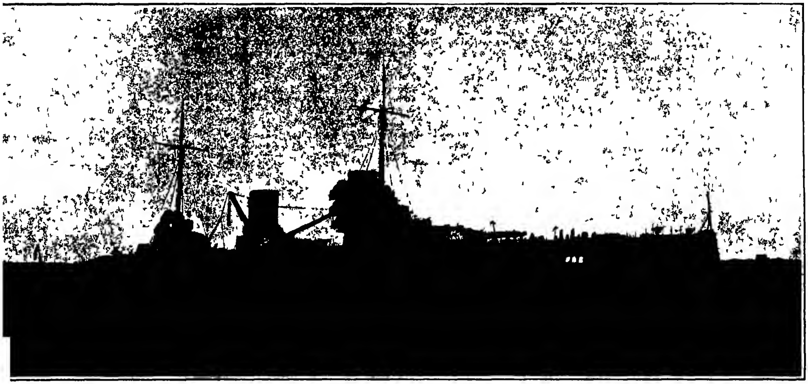
How Germany Has Advanced to the Second Position

By Percival A Hislam

THERE has been a vast number of changes in the last few years in everything that affects naval power, but none is more remarkable than the rise of Germany from a position of absolute insignificance into that of the world's second sea power The work has been accomplished in the face of extraordinary natural difficulties, for not only are the German people essentially agrarian, but their harbors on the open seacoast have had literally to be dug out of the mud, and she must always remain under the heaviest of Nature's handicaps, for the island of Great Britain stretches like a great breakwater between Germany and the ocean

Considering the part Germany plays to-day in the naval politics of the world—she has 11 completed dreadnoughts to England's 18, and to America's 8—it is difficult to realize that her naval expenditure did not reach $25,000,000 until 1897, and that the fifty million dollar mark was not passed until ten years ago. From 1908 onward her naval expenditure has totaled well under a half of Great Britain's and yet in that period she has launched 18 armored ships as compared with that nation's 22, and with the 10 of the United States. The German fleet is largely manned on the conscript system and it is this, of course which accounts very largely for the cheapness of her naval service

To realize the truly marvelous growth of German naval strength it is not necessary to go back more than ten years. In 1902 her naval expenditure was $50,225,000 and it has increased so rapidly that no less than $113,047,200 is being spent this year The number of officers and men voted for the fleet in 1902 was 31,500 For the current year the figure is 62,670, and under the recently adopted amendment to the navy law of 1900 the personnel is to be increased to 101,500 by 1920 For two years after England completed the "Dreadnought" (in 1906) Germany was passing into service battleships of 13,040 tons, more than 30 per cent short of her displacement, but the armored



Length, 610¼ feet. **Beam,** 96 feet **Displacement,** 22,640 tons. **Speed on trial,** 29 knots **Armament,** ten 11-inch twelve 5.9-inch twelve 3.4-inch four torpedo tubes
Main armor belt, 7¼-inch **Coal,** 3,100 tons **Oil,** 200 tons

Germany's latest battle-cruiser, "Goeben."

Length, 564¼ feet. **Beam,** 95¼ feet. **Displacement,** 24,110 tons. **Trial speed,** 22 to 23 knots. **Armament,** ten 12.2-inch, fourteen 5.9-inch fourteen 3.4-inch, six torpedo tubes.
Main armor belt, 13¼-inch. **Coal,** 3,600 tons. **Oil,** 300 tons.

The latest German dreadnought, "Kaiser."

ships launched for Germany from 1900 onward have actually exceeded in average displacement the vessels launched for the British navy. It has been truly said that a battle fleet is not made in a shipbuilding yard or alongside a dockyard wall, but on the high seas, and if the German fleet be measured on this basis, its progress will be found no less striking. In 1902 the "High Sea Fleet" consisted of 8 battleships, 2 armored cruisers, and 22 destroyers. To-day it consists of 18 battleships, 4 armored cruisers, 12 small cruisers and 66 destroyers, and by 1914 it is to be increased (under the provisions of the recent amendment to the navy law) to 25 battleships, 8 battle and armored cruisers, 18 small cruisers, 99 destroyers, and 54 submarines, all of which will be permanently in full commission.

Naturally, the rise of Germany at sea is felt much more keenly in England than in any other country, if only because a distance of no more than 300 miles separates the principal German naval base of Wilhelmshaven from the English North Sea coast. Whether Germany hopes some day to become the world's principal naval power (and the Kaiser has said, "The trident of Neptune must be in our fist," and "Our future lies on the water") is a political matter that cannot be discussed here, but she has at any rate made such progress in that direction that since 1904 Great Britain has been compelled, in order to preserve her superiority in her home seas, to withdraw 19 battleships from foreign stations (14 from the Mediterranean and 5 from the Pacific) and to concentrate practically the whole of her resources around her shores. The extent to which Germany has actually improved her position is shown very strikingly in the following comparison between her fleet and the British in 1904 and at the present time in the principal classes of ships, excluding in all cases vessels launched over ten years.

	1904		1912	
	Britain	Germany	Britain	Germany
Battleships	30	10	27	18
Battle cruisers			5	3
Armored cruisers	19	4	21	6
Protected cruisers	37	17	15	22
Destroyers	120	77	107	88

When the original dreadnought was laid down in 1905 it was claimed in England that the new type of ship would not only strengthen her position very greatly against other important naval powers, but that smaller nations with pretensions to a fleet would be quite driven out of business. This is very far from being the actual result. Some of the minor nations that had not laid down a battleship for a quarter of a century or thereabout are now engaged in more or less ambitious dreadnought programmes, these including Brazil, Argentine, Chili, Turkey and Spain. So far as Germany was concerned, it enabled her to start afresh with a clean slate, and although it is true that the appearance of the "Dreadnought" paralyzed the shipyards of Europe for nearly two years, they were merely preparing themselves properly for the struggle before they started on it. The result is that while England completed seven dreadnoughts before Germany completed one, the latter nation has completed 11 since 1908 to England's 11.

Again, until the "Dreadnought" appeared Germany had been content with comparatively feeble ships. The battleships she launched between 1892 and 1901 carried nothing larger than the 9.4-inch gun and the ships of the "Deutschland" class, the last of Germany's pre-dreadnoughts, displaced only 13,040 tons as compared with the 16,500 tons of the British "Lord Nelsons," and the 16,000 of the "New Hampshires." The first American dreadnoughts were no larger than the "New Hampshires," and the step between the "Lord Nelson" and the "Dreadnought" was only 1,400 tons, but Germany jumped from the 13,040 tons of the "Deutschlands" to the 18,000 of the "Nassaus," an advance of 42 per cent. This phase of German progress is shown in the following table which gives the average tonnage of battleships launched in successive years.

	American	British	German
1905	14,800	16,350	11,040
1906	16,000	16,966	13,040
1907		18,600	
1908	17,333	19,250	18,000
1909	20,012	19,575	22,440
1910	21,825	20,833	22,440
1911	26,000	22,940	24,110

Thus while American designs have gained and kept a considerable lead over both nations' ships, those of Germany have compared with British vessels, risen from an inferiority of 1,310 tons in 1905 to a superiority of 1,170 tons in 1911. On the other hand, however, German designers do not seem to have the knack of converting tonnage into fighting power. Their 24,110-ton ships of the "Kaiser" class mount only ten 12.2-inch guns in their main battery, representing a broadside fire (over a limited angle) of 9,810 pounds. The corresponding British ships have ten 13.5-inch on the center line, with a broadside of 12,500 pounds, while the American "Wyomings" have a broadside of 10,440 pounds, and the "New Yorks," 14,000 pounds. The German vessels have a large anti torpedo battery—fourteen 5.9-inch and fourteen 3.4-inch, as compared with twenty-one 5-inch in the American, and sixteen 4-inch in the British ships, but while a battleship is, of course, a compromise, the battle guns of the German ships of the "Kaiser" class give 407 pounds of broadside for every 1,000 tons displacement as compared with 529 pounds in the British "King George" class and 518 pounds in the "New York."

The German navy now comprises 8 battleships and 3 cruisers of the dreadnought type in service and 9 battleships and 3 cruisers in various stages of construction. The four earliest battleships, "Nassau," "Westfalen," "Rheinland," and "Posen," were launched in 1908. They displace 18,600 tons, and with reciprocating engines of 20,000 horse-power have steamed from 20.1 to 21.4 knots, while their armament consists of twelve 11-inch, twelve 5.9-inch and sixteen 3.4-inch guns. They were followed by the "Helgoland," "Thüringen," "Ostfriesland," and "Oldenburg," launched in 1909-10, and displacing 22,440 tons. Their armament consists of twelve 12.2-inch, fourteen 5.9-inch, and fourteen 3.4-inch guns, and their speeds (with 28,000 horse-power) range from 20.8 to 21.6 knots. These eight ships have their big guns arranged very inefficiently, there being only two turrets on the center line and two on either beam, so that only eight guns bear on the broadside. Thus it happens that the broadside fire of the "Nassau" (18,000 tons) is only 6,080 pounds, while that of the "Michigan" (16,000 tons) is 6,080 pounds. The main armor belt of the first four German ships is 9¾ inches, and of the latter four, 10¾ inches thick, reduced in each case to 6 inches forward and 4 inches aft.

The battleships under construction fall into two groups. The first comprises the "Kaiser," "Friedrich der Grosse" (both under trial), "Kaiserin," "König Albert" and "Prinzregent Luitpold," having a displacement of 24,110 tons, a designed speed of 20 knots (the "Kaiser" has made over 23 in a spurt on trial), and an armament of ten 12.2-inch, fourteen 5.9-inch, and fourteen 3.4-inch guns. The main weapons are in five turrets, of which three are on the middle line, one forward and two aft, the inner of the after pair being superposed to bear astern. The other two turrets are *en échelon* amidships, so that there is nominally a full broadside. The angle covered by ten guns is, however, necessarily small (about 30 degrees), and while the armor belt is increased to 12 inches, it does not appear that very good value has been obtained for the increase of 1,800 tons over the preceding group. The "Kaisers" are the first German battleships driven by turbines, the horse-power being 28,000.

Of the later battleships very little is known save that the authorities are having a good deal of trouble over their armament. The vessels concerned are known as the "Ersatz Weissenburg," "Ersatz Kurfurst," "Friedrich Wilhelm," "Ersatz Brandenburg" and "S." It was at first intended to give them either thirteen or fourteen 12.2-inch guns, but this would have involved triple turrets, and these have, in Germany, proved a failure. As an alternative, ten 14-inch were decided on, but here again, while Krupps have had a 14-inch on hand for a long time, they have been unable to produce a mounting that satisfies the requirements of the Admiralty officials. There is a possibility of twelve 12.2-inch in six center line turrets being adopted as a solution.

America has already made the acquaintance of German battle-cruisers, the "Von der Tann" having visited the southern continent in 1910-11, while the "Moltke" was at New York recently. The former is practically a copy of the British "Indefatigable," having eight 11-inch in four turrets, two on the center line and two *échelonned*, well apart longitudinally, amidships. Her torpedo defense battery consists of ten 5.9-inch and sixteen 3.4-inch guns, while her best recorded speed is 28 knots with turbines of 44,000 designed horse-power. Her displacement is 19,100 tons. The "Moltke," her successor in order of building, displaces 22,640 tons and carries an additional pair of 11-inch guns in a superposed turret aft. She has made 29.7 knots with turbines developing 80,000 horse-power. The recently completed "Goeben" is similar to the "Moltke," but has been credited with a maximum speed of 32 knots. Experience shows, however, that German newspaper reports always exaggerate the speed of their new ships.

Comparative Dreadnought Strength.

	Complete	Building*	Battle Guns in Completed Ships. Total	Broadside.
Britain	18	18	170	156
Germany	11	12	124	98
United States	8	5	80	80
Japan	2	5	24	16
Brazil	2	1	24	20
Italy	1	7	12	12
Austria	1	8	12	12

* Including those provided for in 1912.

It is understood that the last battle-cruiser to be launched, the "Seydlitz," will carry ten 12.2-inch on a displacement of 27,000 tons, but of the remaining vessels, the "K" and the "Ersatz Kaiserin Augusta," of the 1911 and 1912 programmes, nothing definite is known.

No other nation has yet completed a ship of the all-big-gun type.

The Ambrose Channel as Measured by the Panama Canal

When we place two objects side by side for comparison, we may be trying either to magnify the superiority of the one or the inferiority of the other, or again, we may be merely using one as a standard by which to measure the other. It is with this last impartial and dispassionate purpose in view that we have placed some figures relating to the Ambrose Channel beside similar figures relating to the Panama Canal.

When we learned that the broad ship channel cut through the shoals of New York's lower bay was 96 per cent completed, that nearly sixty-five million cubic yards had been removed from it, and that some five million yards were still to be dredged up, we knew that we had a large quantity to deal with, but how large, it was difficult to grasp without using a bigger unit of measure. After searching about for a suitable yardstick, we were quite as astonished as our readers probably will be, to find that the Panama Canal is by no means too large a measure for the purpose. The estimated total excavation of the Panama Canal will amount to about two hundred and ten million cubic yards, or almost exactly three times that of the Ambrose Channel.

To show what this amount of material means in terms of units that are still more familiar to us, we have pictured in the front page illustration two pyramids similar in form, one made of the material excavated from the Ambrose Channel and the other from material excavated from the Panama Canal. Taking the smaller pyramid as 750 feet high, or just large enough to reach to the top of the Woolworth Building, the tallest office building in the world, the base of pyramid would be 2,750 feet square, that is, each side would have a length of eleven common street blocks.

A similar heap of dirt and rock from the Panama Canal would make a pyramid only 1,090 feet high, overtopping the Eiffel tower by something like 100 feet, while the base would measure 4,000 feet square.

How could a work of such great magnitude at our very door have escaped with so little comment? Can it be that things look larger and more important in proportion to their distance? No. This distortion of mental perspective is apparent, not real. There is no doubt that were the work not covered by a screen of water, it would receive great attention and even exaggerated importance. If the same excavation were made in New York city, it would cut a swath nearly as wide as Central Park, and stretching from Canal Street to 125th Street, and about 15 feet deep. But for the very reason that the channel has been dug under water, it is not nearly so important or difficult an engineering undertaking as that of the Panama Canal. Excavation with dredges is far more economical than excavation with steam shovels. The Ambrose Channel was started eleven years ago, and is now practically completed, and yet only four dredges at a time have been used on it, and these dredges were manned by 236 men altogether. At present only two dredges are used in completing the work. On the other hand, the excavation at the Isthmus of Panama has required the services of a veritable army of men. Thirty-five thousand men are now employed. As a matter of fact, what is left to be done in the way of cleaning up the Panama Canal will be accomplished by means of dredges after the canal is open to navigation, because this form of excavation is so much more economical and speedy.

Our front page illustration shows what an enormous load a single dredge will carry. The dredge is provided with two bins, each holding 1,400 cubic yards. To transport 2,800 cubic yards on land would require a train a mile in length, or, as shown in the illustration, four trains, each a quarter of a mile in length. These powerful suction dredges will take on a full load in less than three hours, then go out to deep water, drop the load, and return within two or three hours, depending upon whether their station is near the outer or the inner end of the channel. The load that is taken on is not, as one might suppose, a very fluid mixture of sand or mud and water. Of course, the sand is moist, but it is practically a solid load free from water. The material in the bins, unless it is mud, is so hard that one may walk upon the load without sinking in. As has been explained to our readers before, the material is sucked from the bottom through two pipes, one on each side of the hull, 20 inches in diameter, and provided with a drag at the lower end. The mixture of sand or mud and water is pumped up by powerful centrifugal pumps and delivered into the bins which, after filling, permit the water to overflow while the solids

settle. Thus the bins gradually fill up with the sediment. Mud settles slowly, and much of it is carried off with the overflow, so that when mud is being excavated it takes much longer to fill the bins.

At present practically all the work is completed except for a few stone piles, and for some excavation still to be done along the southern edge of the channel. The stone piles, by the way, are rather interesting. A number of years ago, when harbor regulations were not strictly enforced, it was quite the common thing to dump loads of stone in the lower bay. Many of these have been encountered in excavating the Ambrose Channel. The drags of the suction pipes have openings in them, measuring 7 inches by 8 inches, and will suck up anything of that size, be it stone or iron. However, most of the stones in the stone pile are too large to pass through the drag. They could be removed by using bucket dredges, but a simpler method was evolved, i. e., to bury the stones where they lay. To do this holes from ten to twenty feet deep are dredged around two sides of the stone piles, and then the survey boat with its water jets loosens the pile of stones, letting them fall into the grave dug for them.

The dredges are capable of excavating to a depth of sixty feet. The depth of the Ambrose Channel, however, is 40 feet below mean low water. The width of the channel, as we have stated before, is 2,000 feet, and the banks at each side have a 10 per cent slope.

The importance of this channel in terms of the tonnage of shipping that passes through it looms very large indeed. It has been estimated that for the first few years, the total tonnage of shipping passing through the Panama Canal will not greatly exceed ten million per annum. In 1920 it will probably reach thirteen million. Just how much shipping passes up the Ambrose Channel, it is difficult to determine. A record is kept of foreign vessels entering and clearing the port of New York, but no record is kept of coastwise shipping. The tonnage of shipping engaged in foreign trade amounts annually to about twenty seven million and practically all of it comes up through the Ambrose Channel. The coastwise tonnage is considerably more than this, but how much more no one can state definitely. For this reason we have left it out of consideration in our comparison, and have shown a single ship of ten million tonnage capacity representing the shipping that will pass through the Panama Canal and a twenty-seven million ton ship representing the foreign shipping passing up through the Ambrose Channel.

It is a pity that a waterway of such great importance should have no visible banks. Passengers who go through the Panama Canal will ever praise the engineers who carried that great work to completion, as they see the enormous cut of Culebra, the huge Gatun dam, and the massive concrete locks. But the far greater number of passengers who take the trip through Ambrose Channel to or from New York city will remain perfectly oblivious to the magnitude of the submerged canal beneath them, and to the long years of tedious work spent upon it by devoted engineers.

The Current Supplement

IN an article on Modern Microscopical Optics C. Metz, in this week's issue of the SUPPLEMENT discusses the limitations of the microscope, and the refinements in its optical system introduced by modern practice. The English correspondent of the SCIENTIFIC AMERICAN describes a remarkable aerial ropeway for tourists' service in the Tyrolese mountains.—An important article dealing with Methods of Fire Prevention tells us of the excellent work done by the British authorities in this direction.—Dr. R. C. Benner tells us "Why Smoke is an Industrial Nuisance."—"How to Make an Electroscope" is the title of an article by C. E. Benham.—Mr. John Jay Ide, familiar to our readers as the author of a number of articles on the principal types of aeroplanes, describes for us the Morane-Saulnier monoplane, the holder of the world's height record.—Prof. H. C. Jones of Johns Hopkins University writes on "Electricity and Chemical Action," a subject which he is peculiarly qualified to treat.—E. S. King investigates the question, whether interstellar space contains a medium which absorbs light.

Parcel Post Hampers

THE interest in parcel post appliances will be heightened by the report that Postmaster-General Hitchcock has made a contract for 6,000 hampers to be used in the carrying of parcel post packages. These hampers are intended partly for experimental purposes and are made to nest. They are constructed of canvas and some metal, as well as of wood and fiber, making light construction. It is reported that hampers which can be collapsed have been found in most cases too fragile so that none of the type have been purchased as yet. Many forms of collapsible containers might be developed which would not be open to the objection referred to.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Spring Wheels

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the letter in your issue of February 1st entitled "Fallacy of the Spring Wheel," Mr. Fischer states that the spring wheel will never become a practical success, his reason being that the springs in the wheel must undergo so many more flexures than the elliptical springs of the car.

This is of course true of a great number of spring wheels, but the obvious answer is that if the flexures of the springs in the wheel are in excess of the elliptical springs, the springs must be so placed in the wheel that no flexures occur in excess of the flexures of the elliptical springs.

New York city. HARRY E. SIPE.

The Bow Rudder

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of January 25th, answering the letter of A. H. Kiehl, you make the following statement: "The bow rudder is in use on special types of vessels, particularly on ferryboats, the practice being common in American harbors."

All of the ferryboats on the Atlantic coast of which I have record, are steered entirely by the after rudder, the forward rudder being locked, thereby losing the function of a rudder, in fact the forward rudder can be controlled only from the after pilot house.

I believe that under certain common conditions of current, the bow rudder could be used with success, but I have yet to see one in operation.

Princeton, N. J. ROSWELL DAVIS.

Position of Projectiles in Flight

To the Editor of the SCIENTIFIC AMERICAN:

"The Flight of Projectiles." *Re* article of Sidney Ballou in your issue of December 21st, 1912, page 581.

His second paragraph is as follows: "If a projectile rotated on an axis absolutely identical with its trajectory, the criticism would be sound, but it is just the slight departure from this condition that causes the drift. The moment the projectile leaves the gun, the force of gravity begins to pull it away from the path of the axis of its rotation, and this slight deviation is enough to make the analogy of the baseball applicable."

It might be well for the writer to point out the analogy referred to, especially since the drifts of a baseball and of a bullet are in opposite directions as pointed out by Twining and especially since Twining states that the causes of the two drifts are entirely distinct and different, in other words, that there is no analogy whatever.

Red Deer, Alberta. C. C. GRANT, M.D.

The Nature of the Patent Monopoly

To the Editor of the SCIENTIFIC AMERICAN:

Regarding the proposed legislation for eradication of the monopoly element from our patent laws.

Would it not be well to consider with exceeding care the matter of this alleged monopoly element, and to demonstrate conclusively its existence, before moving to eradicate it?

While in a general way it might be admitted by some that the inventor is a producer, there appears to be no intelligent understanding of the fundamentals of this so important subject, and the general opinion appears to be that in granting a patent to an inventor, society confers upon the latter a favor, a benevolence, and at the expense of society, for which gratuitous gift the inventor is obligated to society, as, for instance, he would be should he receive free a valuable franchise, by means of which franchise he might live in idle luxury at the expense of society. In short, the inventor is considered, whatever attitude toward him be professed, a privileged seeker, a delver into the "pork barrel," a monopolist, and a blackmailing grafter.

It is denied that the inventor is or can be a producer, he is considered merely a forestaller, an appropriator of natural laws in justice free to all, for that no man can produce by mental exercise alone.

This inventor, who may be without hands or feet, says to society, after sitting for years in exhaustive thought, "I have produced a mechanical design which, expressed materially in the form of a machine, will save the labor of a thousand men, enriching society by the labor saved. What will you give me to disclose it, and how will you guarantee payment?"

Society at present replies: "In the first place, you are a liar, you have produced nothing, for you have neither hands nor feet to produce with. Secondly, you are a thief, because you have appropriated and hold secret possession of our natural rights, but, as we know no means by which we may forcibly dispossess you and recover these our rights, and as we greatly desire possession of them, we will agree to pay your blackmailing claim, by granting you a patent right upon the design."

But, if the inventor cannot produce without limbs, how can he steal without them, and what thing economically has he stolen from society?

If all the wheat or cotton be gathered into the possession of a Patton or a Sully, how can monopoly result from such concentration, the wheat or cotton being a labor product and therefore property? How can more than temporary inconvenience result, provided the land from which the wheat or cotton was produced be still accessible to society for the production of a further supply of the desired product?

Thought applied to language produces word combinations or literary designs for the expression of opinions or ideas. Unless title to *language* be conferred upon an individual, so that he alone may produce literary designs, how can monopoly result from any individual possession of copyrights on these literary designs, which rights concern a labor product?

Thought, applied to the laws of mechanics, produces mechanical designs, which expressed materially are valuable to society. Unless title to the *laws of mechanics* be conferred upon an individual, so that he alone may produce mechanical designs, how can monopoly result from individual possession of patent rights on these mechanical designs, which patent rights concern a labor product?

A chemist burns the midnight oil in useful research for fifty years while his fellows carouse. Feeling his energies weaken, he writes the results (in a few hours perhaps) of his years of study, copyrights and rests from labor upon the sale of his book. There are many—even millions of people sufficiently hardy to deny that this writer is a producer, and to assert the equal right of the public to publish and sell this man's book without payment to him.

The inventor, whose is undoubtedly the most exhaustively consuming and poorly paid of labor, he being well-nigh universally a loser physically and financially, produces his mechanical design by years of conscientious, grinding, slavish mental toil and financial expenditure, while the public idly await his product, whereupon these latter, too lazy to produce their own designs, or too graftingly dishonest to acquire them by purchase, proceed to slanderously declare him a grafter and to actually demand equal rights with him in the use of his product.

I must deny that the inventor is a grafter, and that a patent monopoly ever existed or is possible of existence while the basic laws of mechanics are maintained freely accessible to society for the production of mechanical designs.

If Congress, therefore, in well-intentioned ignorance, or at the behest of selfish interests, legislates away from the inventor his property rights into the hands of non-producers, Congress will be guilty not alone of confiscation, but of the very worst sort, because confined to a particular class.

It will discourage unto death the inventive art, the most useful of arts, and when all too late, society will realize that in thus socializing the product of the inventor's toil, greed has at last burst the bag.

Newark, N. J. J. H. RUSBY.

"Snow-rollers"

To the Editor of the SCIENTIFIC AMERICAN:

The little article "Wind-rolled Snowballs" in your issue of March 1st is an interesting contribution to a subject with which meteorologists are tolerably familiar, but apparently the scientific world at large is not. Snowballs of the character described are known technically as "snow-rollers." (See the Supplement to the Century Dictionary.) It is likely that some of your readers will be glad to be referred to further literature on the subject.

The most extensive account of snow-rollers in the English language is that given in the *Quarterly Journal of the Royal Meteorological Society*, vol. 31, 1905, pages 87 to 96. This is mainly a compilation of accounts of the phenomenon previously published in scientific books and journals, and is illustrated. Some of these accounts appeared in the *Monthly Weather Review* (published by the U. S. Weather Bureau).

Probably the most important contribution to the subject of snow-rollers is the article "Schneewalzen" by Rudolf Meyer in *Korrespondenzblatt des Naturforscher-Vereins zu Riga*, vol. 52, 1909. This gives a list and analysis of all cases known to the writer between the years 1808 and 1909, and is accompanied by a bibliography which lists 45 previous papers on the subject, in several languages.

Snow-rollers were observed in Morris County, N. J., in January 1809 by Rev. D. A. Clark, when it is stated that "the whole landscape was covered with snow-balls, differing in size from that of a lady's muff to the diameter of 2½ or 3 feet, hollow at each end to almost the very center, and all as true as so many logs shaped in a lathe."

C. FITZHUGH TALMAN,
U. S. Weather Bureau.
Washington, D. C.

"Uncle Sam's" Appraisers of Merchandise

How Imported Goods Are Examined by Experts to Determine the Duties They Should Pay

PERSONAL liberty in the United States is so complete that we scarcely realize there is a powerful central government to watch over our destinies and make us comport ourselves with proper regard for the rights of citizens in our neighboring States. Frequently an American's first real contact with Federal power comes on his return from a trip abroad, when he is advised that he must pay duty on goods that he has brought with him. He may have looked with contempt on the poor foreigner who must submit to the pettifoggery of an officious government, and he may be returning with a smug "better than thou" attitude only to receive a rude shock to his complacency as the customs officials board the vessel and make him swear out a statement of his dutiable personal effects. Then no matter if he does consider it an invasion of his rights as a freeborn American citizen, he must submit to having his trunk opened, and searched more or less perfunctorily, to make sure that he has not perjured himself. He may even be called aside to answer searching questions about a certain piece of jewelry. Now, how did Uncle Sam know that he had that trinket? For the first time he is aware of a spy system, not unlike that of Russia, which reaches out beyond our shores to foreign lands and keeps track of the purchases of the American tourists. Despite the humiliation of being treated as a smuggler he cannot help but feel a great respect for the omniscience of a government whose existence he barely realized up to that moment.

Although examination of travelers' baggage is the most troublesome work that the Custom House has to deal with, it is a paltry business compared with the collection of duties on general merchandise. The total amount of duties collected for the year ending June 30th, 1912, on articles entered for consumption was $304,[illegible]. Just how much of this came from the traveler is not reported, but obviously it was a small percentage, and it is equally obvious that the cost per dollar of collecting this duty must have been very great as compared with that on general merchandise. And yet, despite the far greater attention to personal baggage, smuggling still continues among tourists, especially those of the gentler sex, who display remarkable ingenuity in concealing their dutiable goods. One customs official hopelessly admitted that "women are born smugglers, and we cannot hope ever to suppress them."

As for general merchandise, the opportunities for smuggling are so remote, the co-operation between the Government and the importers themselves is so complete, and the penalty for smuggling is so severe as compared with the reward it offers, that practically no goods enter the country without paying duty. Take diamonds, for instance, which one would suppose could very readily be introduced into the country because their value per size is so enormous. Not only does the Government keep track of purchasers of diamonds abroad, but the dealers do as well, and they are constantly on the lookout for smuggled stones, realizing that it is to their own interest to report any stones introduced without paying the required tariff. Furthermore, to make it unprofitable to smuggle the stones into the country, the tariff on them was reduced several years ago from 25 per cent to 10 per cent.

Some idea of the enormous amount of work involved in keeping track of the goods that enter this country may be obtained by a visit to the Appraisers' Stores on the lower west side of New York. The building is ten stories high and takes up an entire block, while across the street is an annex of no mean size. In these buildings at least 10 per cent of everything that comes into New York from foreign ports must be examined. During the year 1911 close to 700,000 cases of merchandise, representing merchandise worth a billion dollars, passed through the Appraisers' Stores, and the goods varied all the way from a toothpick to an automobile, and from a rare tapestry to a dead Chinaman's queue. A sample of literally everything under the sun finds its way at one time or another into the Stores, and no matter what its character may be, whether a fifty-karat diamond or a penny doll, it must be gravely considered and its value accurately and scientifically determined, so that the proper custom duty may be levied thereon. To handle this enormous quantity of material engages the attention of 938 men, of whom 134 are examiners. The duties of the examiner are exceedingly difficult. Each man has a certain classification assigned to him, and he must be prepared to determine the wholesale value of any of the various articles that might turn up under that classification. He must be able to tell of just what material or materials the article was made, how much the materials were worth in the market from which they came, and just what was the value of the labor which was expended upon it. Not only that, but he must know the market values of the materials and labor at the time of shipment. This must be determined on his own knowledge and not on the word of the shipper. He cannot depend on anyone else, but must stand on his own statement, which he must be ready to back up with incontestable evidence in case the importer carries an appeal to a higher court. He must be able to detect all the tricks with which unscrupulous manufacturers delude the ignorant public. For instance, in the textiles department the examiner must be able to tell whether a piece of goods contains cotton, linen or silk, and in what proportion. Having determined this, he must know the quality of the material used in making it up. If it is of silk, he must determine whether the silk is artificial or natural. If natural, what kind of silk, and where it came from. If he is in doubt about the matter, he refers a sample to the laboratory, where the fabric is subjected to a chemical test in order to determine accurately what its composition may be. Naturally an examiner acquires before long such an experience as to qualify him as an expert, an experience that it is impossible to obtain anywhere else.

Recently, curiosities, works of art, and antiques, over a hundred years old, have been admitted free of duty. When the tariff was removed on such objects, this country was immediately flooded with all sorts of curios from every known part of the world, and the poor examiner had to determine whether these objects were at least a hundred years old. When we consider that the articles came from the most remote regions, we can readily understand how difficult was the work. Possibly the most interesting work in this connection is that of determining the age of old furniture. Professionals as well as amateur collectors are duped by clever imitation, and frequently it is not until the examiner in the Appraisers' Stores determines the period to which the article belongs that the purchaser discovers that he has been swindled. Usually the examiner can tell at a glance to what period an article belongs. He is not fooled by artificial weathering or by bird-shot fired into the wood in order to give it a worm-eaten appearance, but he is puzzled sometimes when he finds that around a small portion that really is antique, parts of a more recent date have been applied, or modern wood and varnish have been used to restore a wrecked piece of old furniture.

The examiner who has to appraise the work of artists has an exceedingly difficult task. In many cases it is not at all easy to distinguish between spurious and genuine old masters. The work of these examiners is of undeniable value to the country in preventing the importation of counterfeits.

Similar protection against fraud is found in the case of tea. No duty is levied on tea, but all tea must be examined for purity before being admitted into the country. In the tea room of the New York Appraisers' Stores a hundred thousand samples of tea must be tested per year, which represents an import of about

Testing the color and strength of tea.

All Cuban leaf tobacco must be minutely examined.

Stamping imported cigars after they have been thoroughly inspected.

Assaying an alloy in the metallurgical laboratory

Testing sugar solutions with the polariscope to determine percentage of cane sugar

Decolorizing and filtering sugar solutions for polariscopic test

forty five million pounds. One of the photographs shows the manner of testing. Each cup contains a different sample of tea identified by a number marked on the bottom of the cup, and one of the cups contains a standard sample. Which one it is the examiner does not know, for the identification of this sample also is marked on the bottom of the cup. The examiner then proceeds to arrange the cups according to the color and taste of the tea. After the grading is done the samples are thrown away and the cups turned upside down to show the identifying numbers. All the samples on one side of the standard are passed as good tea, while those on the other side are rejected. To make sure that no error has been made the test is repeated with a second set of samples. In order to detect any pigment used in the tea the leaves are mashed on a piece of white paper, and then the paper is examined with a microscope for faint spots of coloring matter. The tests are very rigid and thorough and the United States may pride itself on having nothing but pure tea to drink.

Perhaps the most tedious work at the Stores is the testing of sugar. The tariff on sugar depends upon the proportion of cane sugar the samples contain. This is determined accurately by means of a polariscope which analyzes the light that passes through samples of the sugar syrup. When a beam of light is passed through a Nicol's prism the transmitted light vibrates only in one plane. When this polarized light passes through the syrup its plane of vibration is distorted to a certain extent depending upon the quality or nature of the syrup and on the length of syrup it must pass through. By comparing this distortion with a certain standard it is possible to tell just what proportion of cane sugar is contained in the syrup. To prepare the samples for the polariscope fixed quantities of sugar must be carefully weighed, dissolved in a measured quantity of water, filtered and decolorized. The work is very wearisome and trying, with no variation to relieve the monotony. In the case of sugar only samples are brought to the Stores, and as a check upon the examiner, two samples out of each barrel are given him. Each sample bears its own number but the examiners have no means of determining which two came out of the same barrel. Nevertheless, his work must be so accurate that when like samples are paired again the readings will be practically identical.

The laboratories of the Stores are also kept busy with quantitative analyses of various chemical products, particularly in the search for alcohols in medicines, etc. There is also a section devoted to metallurgical analyses.

Obviously it would be impossible to examine every article imported into the country, and so it is the practice to bring at least ten per cent of a shipment to the

Analyzing drugs and medicines for acids, alkalies, oils, etc.

Smuggler's vest, thirty six pockets for watches and jewelry

How the smuggler conceals dutiable goods in books.

Examining cases of drygoods.

Stores. If the shipment consists of but one or two cases of goods at least one case must be examined. The cases that go to the Stores are picked out at random by the examiner. He compares the contents of the case with the invoice and then investigates one of the articles under the invoice minutely in order to determine its quality. If this tallies with the specifications the case is passed. In certain classes of goods, however, the entire shipment must be minutely scrutinized and appraised. In the case of leaf tobacco for instance every package must be opened in order to determine whether the leaves are good enough to be used for wrappers which must carry a duty of one dollar and eighty five cents per pound, or whether they are fit only for fillers, which pay thirty five cents duty. Certain classes of tobacco which are obviously inferior do not come in for such careful examination but in the case of Cuban tobaccos, a hundred per cent must be brought to the Stores. In the appraising of cigars, a very careful count and estimate of weight and value must be obtained, for not only must the tariff be collected but the boxes or bundles must pay a tobacco tax.

We cannot go into all the details of the work at the Appraisers' Stores but we have mentioned enough to show that it is of a most exacting nature. We must also pay a tribute to the high character of the men employed in this work. It is hard to understand how the Government can afford to hire so many experts. As a matter of fact the salaries are not at all proportionate to the experience and quality of work. Frequently an examiner steps out of the Stores into a position with some manufacturer at a salary many times greater than that he has been receiving from the Government. However as a rule the men are content to stay in the Appraisers' Stores because they become devoted to the work and find it full of never-ending interest.

Artificial Marble

THE following are directions for making artificial marble. 1. Burnt gypsum is saturated with a solution of lime in alum water, burnt again, ground finely or rather pulverized, adding 1/12 by weight of the gypsum of alum, and cast in the mold. These harden very slowly, but attain the hardness and transparency of marble. Different pigments may be added to obtain different colored marbles. 2. Pieces of burnt gypsum the size of a fist are put for 1 hours in a 12 per cent solution of alum in water of a temperature of 85 to 104 deg. Fahr., burnt again, pulverized, adding 1/10 powdered alum and lastly worked into molds with water containing 1/16 sal ammoniac for each part of gypsum. Castings made of this combination possess great hardness and brilliancy and it may, therefore, be used for fine statues.—*Neueste Erfindungen und Erfahrungen.*

Power from Kerosene

A System Whereby Oil, Kerosene, and Distillates are Used in the Ordinary Type of Gas Engine

By L. W. Ellis and W. R. Dray

THE intelligent public has been slow to adopt the oil engine. It has been educated by use to internal combustion engines which make an explosive gas out of cold gasoline. Through its familiarity with the automobile it has come to demand an oil engine that follows established gas engine practice. Probably the greatest single factor in such distinction as John A. Secor has earned is his early formulation of the *doctrine* that the oil engine need not and must not vary in principle from the gas engine. Second only to that, however, ranks his discovery of the *means* for using oil without sacrificing a single desirable feature of the best gas engines. His work, which is just beginning to have world-wide recognition, offers an answer to the general demand. The following article, abstracted from a longer article appearing in the February 15 issue of the SCIENTIFIC AMERICAN SUPPLEMENT, explains the principle of the invention.

The Secor patents do not apply to engines which differ from the familiar gas engine type, such as the Diesel and the vaporizing type, nor to the type using the hit-and-miss governor. They are applicable to the throttle-governed engine only.

Stated concisely, the Secor system covers (1) an automatic variation in the quantity of fuel mixture in accordance with the slightest variation in speed and load; (2) a degree of compression dependent upon the quantity of the mixture inhaled; (3) a correct proportioning of the mixture under all conditions, involving relatively weaker mixtures for the higher compressions and increasingly stronger mixtures for the lower compressions; (4) a temperature of combustion exactly adapted to the quality of fuel used and the compression; (5) automatic control of the internal temperature through the admission of water as a part of the fuel mixture; (6) thorough and uniform mixture of the fuel, water and air charge by mechanical means and without the application of additional heat; (7) automatic variation in the time of firing in response to variations in the speed and power; (8) means for changing the limits of relative speed within which all factors are simultaneously controlled; (9) and means for starting on a limited supply of volatile fuel, all of which factors are vital to the control of internal heat, the transformation of heat into power and power production. These features are now embodied in commercially successful engines which have been adapted to a great variety of stationary and traction work.

One great factor in the success of the system is that through the mechanism of the Higgins carbureter the proportions of fuel, air and water are automatically varied in relation to each other as the compression changes. By this means the conditions within the cylinder, whether the engine is run at heavy load or light, are constant so far as they affect the completeness of combustion. Complete combustion eliminates the deposit of carbon, which has been regarded as an insurmountable objection to the use of heavy fuels, and the unified automatic control results in the securing of splendid regulation.

Crank shaft, cam shaft, governor, magneto, carbureter valves and piston act as a positively controlled unit in engines equipped with the Secor system, hence no one mechanical factor deserves to be set apart from the others in importance. However, the Higgins carbureter, which makes possible the application of the Secor system, is of sufficient novelty to warrant special attention. Fig. 1 shows the top view of a two-cylinder tractor motor equipped with the Secor-Higgins system. The cam shaft is gear driven and in turn drives both governor and magneto through bevel gears. The fly ball governor, through a first class lever and a link coupling, operates a sliding brass plate which is clearly shown in Fig. 3. The carbureter sits above the cylinders, with the short inlet manifold presenting little opportunity for the mixture to stratify before it is

Fig. 1.—Top view of two-cylinder motor equipped with the Secor-Higgins system

Fig. 2.—Higgins carbureter, showing air intake and manifold

completely vaporized. It contains constant level chambers for kerosene and water, an overflow being provided for each. It has also, for starting purposes, a chamber for gasoline which is filled by hand pump. This chamber, which holds about a pint, is connected by a siphon with the mixing chamber. Turning the engine over creates suction enough to draw upon the contents of this chamber, but a vent is provided so that if a start is not made immediately the siphon will not continue to act and drain the chamber.

Fig. 3 shows the position of the valve plate at light load. Two air inlets are then open, providing a large ratio of admission to outlet area and thus greatly reducing the relative vacuum in the mixing chamber. As the load increases, the governor throws the sliding valve forward, increasing the area of the outlet to the cylinders, increasing the air inlet in the middle, and decreasing or entirely closing the air opening at the right. Thus the ratio of admission to outlet area decreases, the relative vacuum becomes greater, and more fuel in quantity, though not in proportion, is picked up by the incoming air and carried to the cylinder.

A sectional view from the side (Fig. 4) shows the arrangement of the kerosene and water needle valves, the overflow, etc. It will be noted that the water level is lower than the kerosene level. The suction, therefore, is not great enough, until the engine reaches about half load, to lift the water to the point (H2) where it can flow down the tube surrounding the needle valve. From half to full load the ratio of water to fuel increases rapidly until the amounts of fuel and water used are practically equal.

The carbureter is so designed that the fuel needle valve A should be adjusted at the full load position when the plate is farthest to the right. This order of procedure is important, since at this position the adjustable plate has no effect upon the area of the air inlet openings. The adjustment of the air should be made at the no-load position, and after once made need never be changed unless the engine enters a very different altitude. This adjustable plate allows each carbureter to be adjusted to the engine it is to serve, hence the slight variations in manufacturing are fully taken care of. The sliding valve is the only moving part in the carbureter, and that is positively controlled. There are no springs, floats or check valves. Wear cannot affect the size of the air openings which control the relative vacuum in the mixing chamber, therefore the accuracy of the carbureter will never be interfered with by any ordinary cause.

Ignition is necessarily electric, and in large engines where the speed variation is great, means have been developed for automatically advancing the spark as the speed increases. On ordinary engines, however, only such manual adjustments are needed or provided as will take care of the starting and normal speeds.

One of the most noted gas engine builders in the country has adapted this system to a line of stationary kerosene and distillate engines which will eventually range in size from 50 to 170 horse-power. His factory tests show an efficiency of over 15 brake horsepower hours per gallon of kerosene on 50 horse-power single-cylinder engines at all loads from about one-third to shortly below the maximum. The manufacturer's literature places a guarantee of within 2 per cent on speed regulation. One other large licensee making stationary engines in sizes from 1 to 15 horse-power is achieving considerable success through a series of electric lighting and power outfits suitable for the country home or small business. The generators are direct connected, yet give steadier power than the average public service in the smaller towns. The U. S. Government is using a number of engines fitted with this system to drive air compressors for foghorns in life-saving stations on the Great Lakes.

A six-cylinder marine engine using the Secor-Higgins

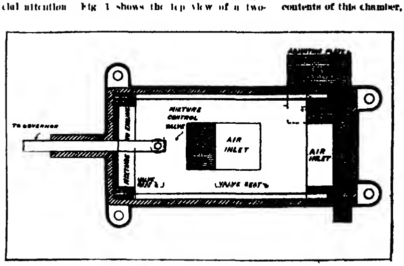


Fig. 3.—Position of sliding valve at light load.

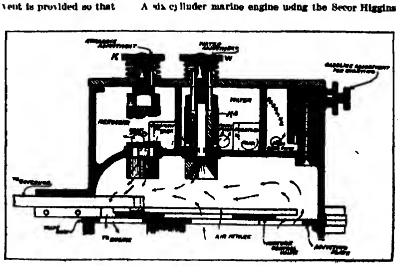


Fig. 4.—Longitudinal section of carbureter.

system develops a brake horse-power hour from 0.9 pint of kerosene. A large number of Secor engines are being used by the Japanese government for operating electric lighting and wireless telegraph stations, and these engines have been adapted to a great variety of uses in this country, where safety and close speed regulation are essentials. Naturally, insurance rates are much lower where a non volatile fuel is used.

The widest use of this system however, has been made in connection with farm tractors. One factory built more than 50 tractors a week as an average for the year 1912. These engines are meeting with universal success, operating on the kerosene and distillates of the United States, on gasoline in South America, and on the lighter grades of crude oil found in the United States and Southern Russia. A two-cylinder tractor, 10-inch bore by 12-inch stroke, running at 375 revolutions per minute, recently developed in an official contest at Winnipeg, Manitoba, 51 brake horse-power in an economy test with a consumption of 0.71 pound of fuel per horse-power hour, and 76.5 horse-power in a maximum test on 0.85 pound of fuel. This is a grade of fuel which sells at 5½ to 7 cents in barrel lots in country towns throughout the Central States, and weighs nearly 7 pounds to the United States gallon.

In the Winnipeg Motor Contest of 1911 a single-cylinder engine of the same type averaged 0.85 of a pint of fuel per brake horse-power hour on kerosene and 0.93 of a pint per brake horse-power hour on gasoline. The kerosene contained 16 to 20 per cent more heat units than gasoline, hence the engine running on kerosene, while a trifle more economical as regards volume of fuel used, was a trifle less efficient thermally. In the last three such competitions, the fuel cost of the tractors operated under these patents has been consistently lowered and has remained at or near the lowest point recorded, while the speed regulation has been scored perfect in nearly every instance. The recent winning of a gold medal and sweepstakes over more than twenty other tractors, including four steam and fourteen gasoline, indicates that the desirable oil burning feature has been achieved without sacrificing any points of excellence. These tractors are being used by ordinary farm hands in every condition of climate and altitude without further adjustment than is provided for in the simple carburetor.

Military Automobile Gun

By the Paris Correspondent of the Scientific American

EVER since the employment of aeroplanes and airships has become one of the recognized elements of modern warfare, attention has been called to the question of cannon for firing upon objects of this kind, and naturally a combination of an automobile with a suitable gun for use in firing at high elevation is sought for. In France where military aeroplane questions are actively taken up at present, designers have been working upon an automobile cannon of this sort, and we here present the most recent and successful type which comes from the De Dion automobile works, the construction having been carried out according to plans furnished by Capt. Houberdon and other army officers belonging to the engineering corps. The automobile is made as light as may be compatible with the load which it is designed to carry, as the car is required to run at a good speed, and to carry this out a good sized 4-cylinder motor is used. On the rear end of the chassis is mounted the cannon with all the proper devices for the firing at a high angle. A turntable base which can be rapidly rotated so as to secure a rapid aiming of the gun is here employed, and another device allows the gun to turn upon its trunnions, the height being regulated by a toothed sector and gearing operated by a hand wheel. All the movements are rapidly carried out, as is required for directing the gun upon objects in the air. When running on the road and out of use, the gun is let down so as to come into the horizontal position, and lies close to the base. During the firing, it can take all inclinations up to 70 degrees, and in this way it fires almost vertically, as our engraving shows. The new automobile gun is meeting with favor in the army, and it has already shown a very good performance in the military manœuvres.

The automobile gun on the road and out of use, comes into horizontal position and lies close to the base.

The automobile gun during firing can take all inclinations up to 70 degrees.

Recent Improvements in the Storage Battery

THERE are about fourteen hundred patents in the storage battery art, as granted by the United States Patent Office. A still larger number is found in the foreign patents. The casual observer might assume

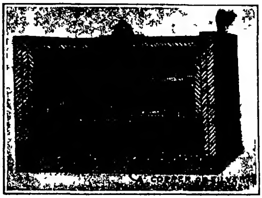


Fig. 1.—Morrison's zinc lead-dioxide cell, showing screens A of copper wire

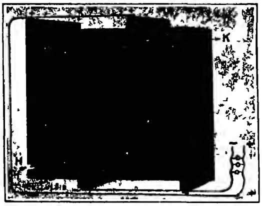


Fig. 2.—Structure of cell used in Basset's electrical battery

from this that there was nothing left to be desired in the battery or that there was no room for further large improvements. On the contrary the perfect storage cell has yet to be discovered. However the present day form of cell is steadily although not spectacularly approaching perfection limited, of course, by certain inherent qualities that cannot be overcome.

The Lead Storage Cell. In the lead storage cell alternate plates of spongy lead and lead dioxide separated by insulators, serve respectively as negative and positive pole electrodes in an electrolyte of sulphuric acid. Upon discharge the lead is oxidized and the dioxide reduced, the resulting products uniting with the acid to form lead sulphate. Upon charging, the reverse reactions occur. Due to these molecular changes the active materials expand and contract. Herein lies the main difficulty in making a battery that will stand up under the stress of usage. The oxides being poor electrical conductors and loosely adherent, a metallic support is essential. The vast majority of patents deal with the structures of such supports. Either a lead oxide paste is applied upon a metallic grid or is held in a perforated container according to the Faure method, or the active material is electrolytically formed *in situ* upon a plate generally comprising thin closely spaced leaves of lead by the Planté process of alternately oxidizing and reducing the plate.

Expanders. Active material where exposed on the exterior of a plate tends to flake off or disintegrate. Of the various expedients to obviate these difficulties, the use of a so-called expander is most common. That is, the active material is impregnated with a finely divided inert insoluble substance, often an electrical conductor. For example, Rodman soaks the dried plate in barium nitrate solution and then dips it in sulphuric acid, thus precipitating insoluble barium sulphate within the pores of the electrode. He also subjects a plate of barium-lead alloy to anodic oxidation in sulphuric and nitric acid, thereby forming lead dioxide and setting free the barium, the latter being then transformed to a sulphate. Ford soaks his plate in a tannin solution containing deflocculated graphite in suspension. Morrison uses oxygen compounds of chromium, tantalum, niobium or tungsten. For example he electrolyzes the ordinary lead dioxide plate as an anode in a sodium tungstate solution, thereby forming a tungsten oxygen compound within the pores of the electrode. Morrison also describes the use of such agents as nitro-celluloses, especially celluloid, or rubber vulcanized in the plate.

Initially Formed Active Material. Salom works on the problem from another viewpoint. He first electrolytically forms or, as it were, charges the spongy lead or lead dioxide, so that it is initially fully expanded, and then applies it to the grid under hydraulic pressure. The spongy lead is bonded by allowing water to evaporate from the powdered lead crystals, thus oxidizing it superficially throughout.

Quick Discharge. An essential for a quick discharge is that the pores in the active material be so large that the acid does not become impoverished at the working surfaces. This has been accomplished by mixing the lead oxide paste with various compounds which are dissolved when the plate is formed, such as sugar, salt, various silicates, carbonates, etc., or powdered metals, such as zinc dust. Marino specifies an agglutinant of glycerine, soluble starch and water glass. Others make up a Planté plate of a lead alloy, such as lead-zinc, and afterward chemically or electrochemically dissolve the zinc or other alloying metal.

Hannover in Denmark casts a plate from a mixture of a metal and an alloy, e. g., of lead and antimony, applies heat until the eutectic alloy becomes fluid while the remainder is solid, and then squeezes out the fluid particles leaving a spongy plate. He then galvanically precipitates metal of a higher melting point within the pores, heats and melts out the original material.

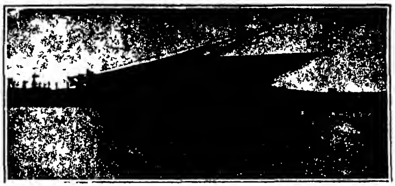
Tate accomplishes the same end in a bifunctional electrode made up of interleaved strips, alternately positive and negative and suitably separated by porous earthenware plates, which carry a supply of acid. Each strip is about one-half inch wide and the active material is but one thirty-second inch deep, thus exposing substantially the whole mass to the electrolyte.

The Iron Nickel Cell. The iron nickel

(Concluded on page 264.)

Ice-boating

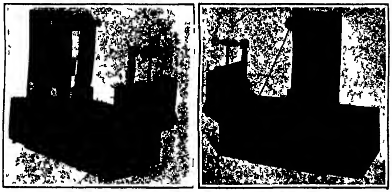
A FEW weeks ago we described the exhilarating sport of motor ice-boating, and showed some of the more substantial types of motor-driven sleds. One might be tempted to think that the motor ice-boat would eventually render the wind driven iceboat obsolete. Such, however is hardly likely to be the case when we consider the rare sport that can be obtained with the wind propelled vehicle. The accompanying photograph shows an exciting moment in an ice-boat race. The ice boat is lifting to an alarming angle and it seems as if it must surely topple over but it will right itself and continue on its course. Surely a sport affording such exciting moments is not liable to die, for ice-boating is purely sport, and there is no utilitarian reason for introducing motors as has been the case in sailboats. The only reason for the motor ice boat is that it affords a different kind of sport. The two types of ice vehicles will surely be continued and developed side by side.



An ice boat "lifting" to an alarming angle

The Micro-monophone

THE micro-monophone is a tuning fork kept in permanent vibration by means of a microphone contact. This is an improvement over the familiar tuning fork interrupters for the reason that its sound is much clearer while the current curve approaches much more closely to a sinusoidal form. Two views of the apparatus are shown herewith. The tuning fork is mounted upon a resonance box. The prongs of the fork are situated in the field of an electro-magnet on which is superposed the field of a permanent magnet. The coils of the electro-magnet are arranged in series with a microphone mounted at the closed end of the resonance box. The support for the microphone is such that it may be moved to bring the lower carbon electrode into contact with the resonance box. When current from a battery is passed through the microphone and the electro-magnet and the tuning fork is set vibrating by means of one or two slight knocks, vibrations will be transmitted through the resonance box to the microphone producing variations in the magnetic field of the electro-magnet which in turn acts upon the tuning fork and keeps it vibrating. Thus we have a complete cycle of operation, the tuning fork keeping the microphone in operation and the latter by means of the magnet keeping the tuning fork vibrating. The tuning fork will then vibrate as long as the battery current is complete or unbroken. By reducing the current intensity the purity of the sound is increased.



Apparatus for keeping a tuning fork in constant vibration.

Acorns and Their Uses

VERY little attention has been given in this country to the utilization of acorns. It is well known that they are used as food for cattle, horses, swine turkeys, and those of several species of white oaks also form the food of man.

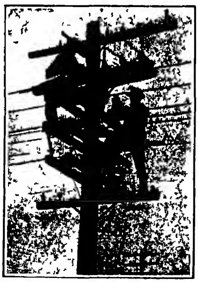
The acorns of white oaks are mostly large and the trees in general produce fruit very abundantly. The Indians in California always gathered the acorns of the California live oak (*Quercus agrifolia*) and years of great scarcity often caused much misery. Even the early white settlers of California relied on the crop of acorns as a part of their food supply. The acorns were gathered by the squaws, who preserved them by putting them in wicker baskets which were generally stored in hollow oak trees or in caches as shown in the illustration. They were prepared for eating by grinding and boiling them with water into a thick paste which was baked into bread. The oven consisted of a hole in the ground about 18 inches each way. Red hot stones were placed in the bottom of it and a little dry sand or loam placed over them. Next a layer of dry leaves was spread over this and the dough or paste poured into the hole until it was two or three inches deep. A layer of leaves, more sand, red hot stones, and finally earth was placed on top. At the end of 5 or 6 hours the stones had cooled and the bread, which was an irregular mass nearly black in color, was taken out.

In parts of the South acorns of the cow oak (*Quercus michauxii*) have been used when roasted as a coffee substitute, and there are a good many other uses to which they might be put. Alcohol can be extracted from them, as from all starchy substances. Starch is at present made principally from rice, corn, and potatoes, but if the starch from acorns is sufficiently refined it may be employed as an article of diet as well as for laundry purposes. Acorns contain much sugar and gum, and it is probable that these substances can be profitably separated and successfully used for domestic purposes. Even the residue could be sold very profitably for fattening hogs.

Transporting a bridge girder in Southern India.

Engineering in Southern India

AT first sight there appears to be nothing very remarkable in the accompanying photograph which shows the floating into position of a large girder. The girder is a hundred and fifty feet long and it is supported in the well known manner upon two floats to permit of transporting it down the river. The weight of the girder is 200 tons, certainly not remarkably heavy. But closer inspection of the photograph shows a small boat on the river with a lateen sail, and in the foreground a dugout canoe which gives us the hint at once, that the girder is being transported on some Oriental stream. It seems rather incongruous, does this introduction of a bit of western engineering in the picturesque Oriental stream. The girder is being floated down the Netravati River at Mangalore Southern India over which waterway a bridge is being built. Although the transporting and placing on its piers of such a girder is a simple matter in our land it is no inconsiderable feat where ignorant native workers must be relied upon.



Protected by shields in a network of high-tension wires.

Standing on the shields while fixing an arc lamp.

Rubber Shields for Linemen

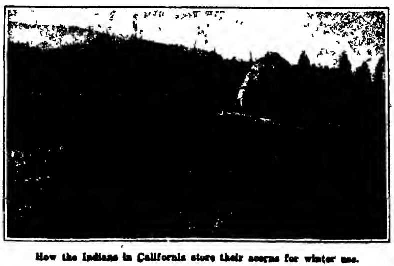
OF the millions of people employed daily about exceedingly dangerous tasks, few are subjected to greater danger than the linemen employed by the thousands upon thousands by electric lighting and power companies. These men daily place themselves in the most hazardous positions among high tension wires. For the protection of this class of employees a rubber shield has been invented.

The shield has the form of a rubber trough. It is used in all possible positions where the body of the operator may be exposed and is also used as a means of protection in trimming arc lamps and repairing broken wires from the ground. In the latter case if the weather is dry the shield is simply stretched upon the ground for the repairman to stand upon, but in case of wet weather when this insulation is not sufficient the shield is closed at the flaps.

The appliance is manufactured of pure Para rubber, three layers of the rubber being used to two layers of canvas, the latter alternating with the rubber sheets. The second layer of canvas used is laid crosswise to the first layer, and in this way adds greater strength to the shield. The thickness of the rubber varies from 3/8 inch in locations where it is liable to be subjected to pressure to 3/16 inch along the closing flaps. The contrivance is fastened to the wire by two hard rubber rings. These are slotted with an aperture sufficiently large for the wire to enter and then clamped by this means firmly to the wires from which the lineman must be protected.

Each shield is subjected to a test of 30,000 volts submerged, but it is recommended that the protector be used only with voltages not exceeding 10,000.

It will also be noticed that this new life-saver fits over the insulators, and in fastening it to the wire the lineman grips the rubber handles attached to the outside ends of the shield in such a manner that it is between his hands and the wire.



How the Indians in California store their acorns for winter use.

Inventions New and Interesting

Simple Patent Law, Patent Office News: Notes on Trademarks

A New Gear Engine

TWO small spur gears cutting through a steam chamber at their intermeshing point—this is practically all there is to an engine, which has recently been tested at the laboratory of Columbia University, at the power house of the New York Central Railroad, and at the Chicago and Northwestern power house, where it developed thirty five horse-power with better economy than the average multi stage turbine or piston engine of equal power

The construction of the engine is shown in the accompanying drawing, in which the two gears *A* are mounted in a suitable casing *B* At their intermeshing point there is a centerpiece *C* containing two steam chambers, for this is a reversing engine The dotted lines *D* and *D'* outline the chambers, and they communicate with the pipes *E* and *E'*, respectively When steam is admitted through the pipe *E*, it fills the chamber *D* and can escape therefrom only by propelling the teeth of the gear wheels in the direction of the arrows. The escaping steam fills the casing *B*, and most of it escapes through the exhaust *F* Some of the steam is carried by the teeth into the chamber *D'*, and escapes through the pipe *E'* which is connected with the exhaust When it is desired to reverse the engine the pipe *E* is connected with the exhaust and steam is admitted to chamber *D'* through pipe *F'* Such is the construction of the single stage type of engine Very evidently the parts may be duplicated to produce a multi stage gear engine

The following is a report on the engine tested at Columbia University Mechanical Laboratory and the New York Central Power Station

"The results show a very good water rate for this size of unit The engine has the following salient points of design, Speed may be varied over a wide range. Weight per horse-power and floor space per horse power are very low No foundation is required for this size unit, the machine tested was operated without vibration under load up to 4,000 revolutions per minute standing on a wooden bench. There are of course, no dead centers and no reciprocating parts. The external gears establish the running clearance of the working gears, so that there is no contact and no lubrication in the engine required It has a high starting torque, as the full steam pressure can be utilized at the outset. The engine is symmetrical with respect to steam and exhaust, so that it can be reversed without difficulty and operates equally well in either direction. The engine is entirely inclosed, and slugs of water have no effect except a temporary slowing down As the engine can be equipped with two pulleys revolving in opposite directions, belts can be operated if necessary on very short centers, as one pulley can act as an idler in securing additional wrap on the other pulley It obtains its good water rate by eliminating most of the other losses which occur in small engines and turbines, such as cylinder condensation and leakage in a reciprocating engine, and windage and steam friction in turbines."

This engine easily delivered 50 horse-power on the brake and the above figures were estimated from that basis.

Various tests have been made in the past on the single-stage unit to determine the increased economy of the multi-stage gear engine. The results of these tests have brought to light an entirely new method of expanding steam, heretofore unknown to authorities on thermodynamics. The expansive power is obtained in this new cycle while the steam is working at a continuous flow against a series of pistons, having what is termed an infinite receiver between them, which consists of merely steam passages between successive and closely adjacent stages the number of stages determining the amount of expansion obtainable. The following is quoted from a report by Prof Parr based upon tests made by Prof Pigott both of Columbia University

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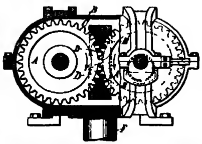

Fig 1.—Details of the gear engine.

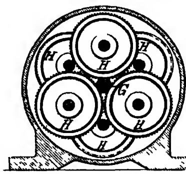

Fig 2.—Speed reducing gear

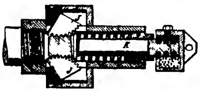

Fig 3.—Section through the governor

New single stage gear engine.

The gear engine undergoing a test

Machines for Printing Railroad Tickets

IN a large railroad system the cost of supplying storing and issuing tickets to passengers is no small item In the system generally followed in this country each station agent is required to keep on hand a stock of complete tickets for each principal station on the road and blank tickets for the less important ones in which the name of the destination is written or printed with a rubber stamp This latter class of tickets is always a source of trouble, as that they are subject to forgery and the liability to error in accounting Furthermore, cumbersome ticket cases are required to hold these tickets and in large stations such cases take up much valuable space

In view of the foregoing facts it would appear that a comparatively simple and practicable machine by which it would be possible for the ticket agent to print each ticket as it is called for would receive careful consideration by the railroad companies Many ingenious machines have been invented for doing this work Practically all of them have a fixed plate for printing the body of the ticket such as the name of the road the conditions under which the ticket is sold etc, and movable or removable type plates for the place of destination and date They also are so arranged that at least the destination of each ticket printed is also printed on an auditing strip which is of great assistance to the agent in auditing his accounts, and may be turned in with his reports.

In Fig 1 is shown the first complete machine of this kind patented in this country in 1873. A roll of paper in ribbon form having printed thereon the main body of the tickets is placed in the lower cylindrical part *a* of the machine The end of this ribbon passes up over a feed roller in the upper cylindrical part *b* and thence out over the platen at the top A curved arm *c* is pivoted at the back of the machine and at its front are recesses for removably holding the type plates *d* for the destination and the date At each complete revolution of the crank shaft the paper strip is fed forward the space of one ticket and by means of eccentrics an ink ing roll *f* is passed over the type plates and the arm is brought down on the platen thus completing the ticket The ticket thus printed is then cut off The auditing strip lies alongside the ticket strip and is fed forward at a slower rate and the identifying matter is printed thereon at the same time the ticket is printed

The next view (Fig 2) shows one of the most recent forms of this type of machine In the upper part of the casing is a horizontal shaft turned by a crank and carrying a mutilated bevel

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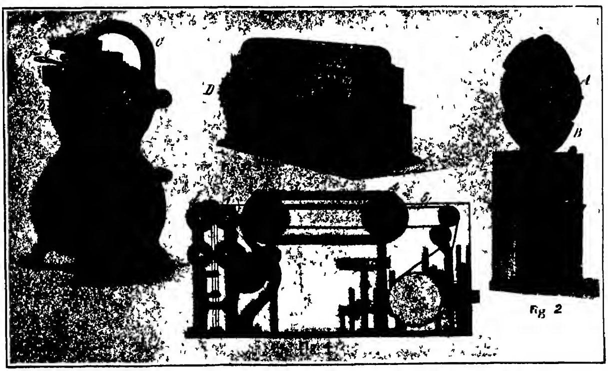


Fig 1.—The first machine patented in the United States for printing railroad tickets. Fig 2.—One of the most recent forms of printing machines, in which all tickets are numbered with one serial number Fig 3.—In this machine the tickets to each station are printed with their own serial number Fig 4 shows an improved machine with the cash register feature.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

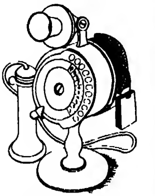
Pertaining to Aviation.

AEROPLANE.—J. ANDERSON, West Mount Vernon, Maine. This invention provides carrying planes; provides a carrying structure manually controlled to effect a proper means for facilitating the banking of the machine when turning a curve or to regain its equilibrium; provides a car to protect the aviator and motor with the least retardation of the flight; provides an inclosed casing for the motor employed in conjunction with the aeroplane having an exhaust duct opening at the rear to convey the sound of the exhaust away from the aviator; and provides a car body shaped to the wave line of flight to avoid the suction at the rear of a fast moving body.

Electrical Devices.

HIGH VOLTAGE STRAIN INSULATOR.—L. STEINBERGER, Brooklyn, N. Y. Mr. Steinberger's invention relates to strain insulators for high voltage electric conductors to be used in various relations and for various purposes such as power transmission, and for guy wires or cables employed as stays for towers or for poles, masts and other supports used in wireless telegraphy and telephony, as well as in ordinary commercial work.

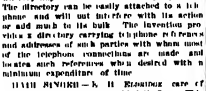
TELEPHONE DIRECTORY.—J. SOSTHEIM, Eu. 1440 Emerson St., Lincoln, Neb. This invention relates to telephone directories and more particularly to a device which comprises a plurality of circular members carrying reference characters and provided with means



TELEPHONE DIRECTORY

whereby any desired reference is rapidly found. The directory can be easily attached to a telephone and will not interfere with its action or add much to its bulk. The invention provides a directory carrying telephone references and addresses of such parties with whom most of the telephone connections are made and locates such references when desired with a minimum expenditure of time.

HAIR SINGER.—E. H. ELDRIDGE, care of Peoples Light Co., Corpus Christi, Tex. This singer is adapted to ease and rapidity of operation and is characterized by a pocket adapted to receive the smoke resulting from singeing hair, thereby doing away with odors, there being a reduction of pressure within the pocket and maintained by any suitable means. The singer has a heating element adapted to en-



HAIR SINGER.

gage the hair as it is lifted or raised by means of a comb or similar article whereby the ends thereof may be singed, the burned material and smoke resulting therefrom being carried into the pocket in the device and conducted away.

Of Interest to Farmers.

DRAFT ATTACHMENT FOR BINDERS.—H. J. DEAGAN, Orlando, Okla. This invention provides an attachment supported on carrying wheels and provided with means for attachment to the body of the binder in the cutting position of the same, and with means for securing the platform of the binder upon the attachment when transporting the binder from place to place.

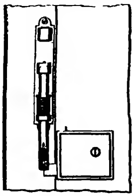
CANE PLOW.—W. L. BOATRIGHT, Glendale, and A. J. McNEILY, of Columbia, Tenn. Address J. C. Yorkes, Columbia, Tenn. The object in this instance is to provide means for supporting a gang of plows in such manner that the plows will be yieldingly held spaced apart laterally and wherein the plows may yield upwardly and may be set to cut at varying depths, loosening but not turning the soil.

WILD OATS SEPARATOR.—A. HOLLAND, Nome, N. D. This inventor provides a device having a few parts and consequently not liable to get out of order, which will quickly and effectively separate the wild oats from the cultivated oats, delivering the former at one end of the device and the latter at the other end.

Of General Interest.

TOOTHACHE REMEDY.—D. FRIEDSOHN, 1822 Madison Ave., New York, N. Y. By use of the paste of this invention in an affected tooth quick relief of pain is had, and at the same time the paste on hardening forms a temporary filling, thus protecting the nerve and pulp against air, solid food and hot and cold liquids.

ALARM.—E. C. RICKER, Scranton, Pa. The object here is to provide an alarm device adapted to be used on either side of a door casing with doors opening in either direction. Further to provide in a certain structure an alarm device which will give warning whenever an attempt is made to open a particular door, thereby either frightening away an in-



BURGLAR ALARM

truder or making his capture easy. This thief and burglar alarm gives warning through the explosion of a cartridge or other explosive constructed and arranged to be set or engaged from either side of a door or opening and particularly adapted to engage with the bolt of a rim lock and released by a push or pull from either side of the lock or other suitable connection.

SODA FOUNTAIN ATTACHMENT.—H. A. GRIFFIN, Drawer 8, Rocky Mount, N. C. This invention is an attachment for spigots of soda founts for stirring and mixing the syrup or flavoring extract with carbonated water in drinking glasses, this operation being effected automatically by the flow of the carbonated water when discharged into the glasses, which have been previously supplied with a due quantity of syrup.

AWNING FIXTURE.—E. H. WEAVER, 23 Gregory St., Jersey City, N. J. This inventor provides hanging fixtures for the head bar of awnings which may quickly be installed and removed from service position and provides socket for hanging fixtures adapted to hold the fixtures in a substantially vertical position to avoid the cramping of the fixtures and the rod when in service relation.

HORSESHOE.—H. K. KING, Temple Court, 1 Beekman St., New York, N. Y. The object here is to provide an overshoe to fit on the hoof over the ordinary shoe in order to prevent slipping or sliding on ice or wet pavements, and so constructed that the different parts may be readily attached together and to the hoof of the animal, the overshoe being so arranged that the parts brace one another and readily conform to the configuration of the hoof. This is attained by placing a reinforced pad under the hoof and fastening this pad to the hoof by means of a particular framework and straps.

Hardware and Tools.

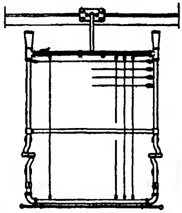
BELT BUCKLE.—L. SANDERS, 621 Broadway, New York, N. Y. It is the design of this inventor to provide a buckle in which the housing and back plate shall have such conformation and relation to each other and such a correlation with the roller that the roller will effectively grip a belt of any thickness ordinarily handled by the trade.

COMBINATION TOOL.—C. A. NORBERRY, P. O. Box 306, Fort Bragg, Cal. This invention comprises a miter square having a pivoted blade with a protractor attachment to indicate the position of the blade, a spirit level and scratch awl, a recess or notch in one edge to adapt the device for use as a center gage and a plurality of means carried by the pivoted blade for marking a mortise on lumber, by the person using the tool.

Household Utilities.

HOLDER FOR BROOMS AND LIKE ARTICLES.—A. L. ROSS, 763 Lexington Ave., New York, N. Y. For the purpose of this invention use is made of a wire bracket adapted to be fastened to a wall or other support, and a wire bail for the passage of the stick of a broom or other article, the bail being mounted to swing on the bracket and being provided with a pin adapted to engage the stick at the rear side thereof.

FOLDING AND REVERSIBLE BED.—D. J. SPINKS, 141 Stone Ave., Tucson, Ariz. This invention has reference generally to beds, the object being to provide a folding and reversible bed frame which is particularly adapted to be permanently mounted between two rooms, for



FOLDING AND REVERSIBLE BED.

instance an inside sleeping room, in such manner that it may be readily and quickly folded to assume an operative position within either room and also movable to an upright or folded position within either room in which it may be in use.

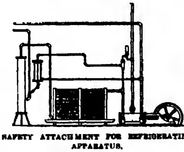
Machines and Mechanical Devices.

SAW TENSIONING AND STRAIGHTENING MACHINE.—T. W. ROACH, Lyman, Wash. This improved machine is especially designed for operating on circular saws although not limited in all its features for use with circular saws. The machine is serviceable also for use in straightening a concaved saw that has been forced over the saw collar.

VALVE.—M. J. WALSH, 124 E. Pine St., Mahanoy City, Pa. This inventor provides a blow off valve so constructed that the main valve and its valve seat may be moved to a position outside of the casing whereby it may be ground or otherwise repaired, and provides an auxiliary valve and valve seat which closes the valve and prevents leakage to the atmosphere at and during the time the main valve and its valve seat are exposed for repairs.

SPRING HAMMER.—J. H. PHILLIPS, care of Dougherty Smith, Phillips Co., Oklahoma, Okla. This invention more particularly relates to a mechanically-actuated hammer. It is an improvement over the hammer in Mr. Phillips' co-pending application serial No. 533,867. An object of the present invention is to provide a hammer which is automatic in its action and which will receive its direct force from a compressible spring.

SAFETY ATTACHMENT FOR COMPRESSION REFRIGERATING APPARATUS.—F. A. SCHNEIDER, 295 E. 162nd St., Bronx, N. Y. This invention relates to refrigerating and ice making systems, and its object is to provide a safety attachment for compression refrigerating apparatus arranged to automatically shut off the ammonia to the expansion coils, and to sound an alarm in case the pressure in



SAFETY ATTACHMENT FOR REFRIGERATING APPARATUS.

the systems exceeds the normal pressure. In order to accomplish the desired result use is made of means for closing a valve controlling the ammonia to the expansion coils, and for sounding an alarm.

Railways and Their Accessories.

AUTOMATIC CAR OILER.—J. T. McREYNOLDS, Lilly, Ill. The object of the invention is to provide an inexpensive automatic car oiler simple in construction and efficient in action inclosed in a car journal box, and the efficiency of which is independent of the direction of rotation of the axle.

OPERATING DEVICE FOR STATION INDICATORS.—W. B. HILL, Hotel Senera, San Francisco, Cal. The object here is to provide a simple and efficient operating device especially adapted for use with the type of indicator shown and described in Mr. Hill's co-pending application No. 566,245. The device is operated by fluid under pressure, and the display mechanism may be operated by trips preferably arranged on the trolley wire at places where announcements are to be made, or by mechanism driven by movement of the car which mechanism will actuate the displaying device at the proper intervals.

RAILWAY CONSTRUCTION.—G. SYMES, care of Coughton & Brecse, Mason City, Iowa. The invention is an improvement in the class of railways in which the running rails rest on arched metal chairs or supports that are in turn secured to transverse metal ties. The invention is embodied in the construction and connection of the chairs or rail supports and the transverse ties connecting them.

NUT OR LOCKING DEVICE FOR SCREWS.—G. LASKOVSKY, 5 Avenue du Bois de Boulogne, Paris, France. This inventor provides a nut or locking device for securing screws and particularly for the screw spikes in railway sleepers. The device offers great resistance to the tearing out of the screw spikes even when the sleepers are made of soft wood.

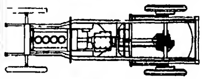
FLANGE OILER.—C. F. HOOVER, 345 Chemical Block, Spokane, Wash. This invention refers to improvements in devices for lubricating flanges of locomotives and other track vehicles. An object is to provide means whereby the flanges of locomotives or other vehicles may be oiled automatically at certain places where such lubrication is most necessary, such as on curves in the track.

Pertaining to Recreation.

GAME.—F. C. CRAW, 4459 Evanston Ave., Apartment N, Chicago, Ill. The intention here is to provide an improvement in games, in which is provided a board representing a baseball field and a series of figures representing the players, and wherein the figures may be manipulated on the board to imitate the movements of actual players in the game of ball.

Pertaining to Vehicles.

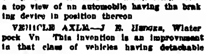
AUTOMATIC BRAKING DEVICE FOR AUTOMOBILES.—J. E. FISHER, JR., 84 W. 76th St., New York, N. Y. This invention relates to braking mechanism for automobiles and motor vehicles in general, and it is designed to be automatically thrown into action



AUTOMATIC BRAKING DEVICE FOR AUTOMOBILES.

to prevent racing of the driving wheels of the machine when, owing to the nature of the road, or from any other cause, frictional engagement of one of the driving wheels with the ground is lessened. The engraving shows a top view of an automobile having the braking device in position thereon.

VEHICLE AXLE.—J. E. HENGER, Winterpock, Va. This invention is an improvement in that class of vehicles having detachable



VEHICLE AXLE.

journals or spindles, and particularly in that class in which the axle ends are slotted and the journals or spindles provided with shanks adapted to fit in such slots. The chief objects of the improvement are to avoid weakening the axle by the construction required to affect such engagement.

Designs.

DESIGN FOR A HAMMER.—H. B. WILSON and H. O. GEPHART, care of Van Dorea Mfg. Co., Chicago Heights, Ill. This ornamental design for a hammer represents an implement of excellent proportions, and the effect of the angles in this design contributes to producing a hammer of very fine lines. The same designers have patented another design of a hammer which corresponds with the first, except that the end of the tool is perfectly plain.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

The Industrial Need of Technically Trained Men—I.

Scientific Manufacturing and the Opportunities It Offers

By Waldemar Kaempffert, Managing Editor of the Scientific American

[IT is the intention of the SCIENTIFIC AMERICAN *to publish a series of monthly articles on the professional opportunities that await the technically trained engineer physicist, chemist, bacteriologist and technologist in modern life. Last year, it will be remembered, a series of articles was published written for the most part by well known educators connected with our leading technological institutions. They showed how institutes of technology were endeavoring to meet the requirements of great manufacturing railway and municipal corporations This year's series, written by the heads of great corporations—companies which are capitalized at millions of dollars, which employ thousands of men, and which are scientifically organized and managed—will show how great is the need of trained chemists and engineers As an introduction to the series we publish the following review by our Managing Editor, the purpose of which is to give a glimpse, as it were, of the rich prizes that can be won by the trained technologist* —EDITOR.]

The modern manufacturing corporation, which requires acres of floor space to carry out its processes, which each day converts whole train loads of wheat, leather or iron ore into flour shoes, or steel rails, needs brains more than brawn. So vast are its operations that it pays to save a few cents in the production of a ton of pig iron, to devise a steam shovel which will scoop up five tons of ore at a time with a slightly less consumption of energy than was possible before to analyze chemically the wastes of manufacture and to devise means of utilizing them No manufacturer can afford to ignore the technologist Competition is no longer consigned to the selling market There is a rivalry in improving manufacturing methods as well as in merchandising Millions are annually spent by business men on scientific and engineering investigations that would have been regarded as purely academic twenty years ago but the ultimate commercial value of which is immediately apparent to the broad minded merchant of to-day Even the manufacturer who employs only a dozen men must engage in this intellectual rivalry He cannot always afford to engage permanently a laboratory expert but he must at least obtain the advice of a consulting chemist or engineer if he is not to be utterly crushed.

Despite its utilitarian and commercial character much of the scientific investigation undertaken by the great modern manufacturing corporation has a fascination all its own Indeed, the results achieved often affect not simply one particular industry, but a whole science In the city of Cleveland for example one of our great electrical companies maintains a number of laboratories, the sole purpose of which is to improve our methods of illumination, and to give us a light which is more efficient than anything now produced The studies there conducted involve chemical and physical research of a high order, physiological and psychological studies of the effect of various illuminants on the human eye engineering researches that will measurably bring us nearer to the "cold light," of which illuminating engineers have lately written so much In a word the entire subject of light is studied with a thoroughness never before attempted and with a total disregard of money Who can doubt that research thus conducted will not simply enrich the world with illuminants better and cheaper than anything we have now, but that the whole science of optics will assume a new importance?

Because of the huge capital which it commands, the modern manufacturing company can experiment on a stupendous scale to realize an idea correct in theory The development of the Curtis steam turbine for example involved the expenditure of millions That vast sum was not spent in empirical experimenting, but in practically testing the thermo-dynamic views of engineers whose one task in life was the perfection of the steam turbine Work such as this is comparable with the finest research conducted in any university What is more, it is richly paid for, for your great manufacturing corporation, unlike your great university, is not niggardly in rewarding the trained men to whom the development of its processes is due.

It has been supposed that the all-devouring trust crushes its weaker rival by the sheer weight of its money The truth is that trained minds easily triumph over mere money In twenty-six public hearings recently held in Washington by the House Committee on Patents, to consider the views of inventors and manufacturers on the advisability of introducing compulsory licenses into our patent system, it was abundantly demonstrated that the trained technologist is more than a match for the trained capitalist The patent counsel for the greatest sewing machine manufacturing company in this country testified that were it not for the experimental laboratories conducted by three or four smaller sewing machine manufacturers, the company that he represented would undoubtedly monopolize the market In other words, a handful of highly paid and splendidly trained technical men were able by sheer ingenuity to cope with the dominating company

Before the same Congressional committee Mr Spencer B Miller a well known engineer, drew a vivid picture of the manner in which a modern manufacturing company utilizes trained engineers. Mr Miller has made a life study of conveying machinery To him we owe the system of coaling battleships at sea, which has been adopted by the United States Navy He revealed the manner in which his company had deliberately studied market conditions and devised machinery to meet special needs. Cypress logs, for example had long been hauled out of Louisiana swamps at an enormous cost Mr Miller was engaged to devise the best mechanical system possible for taking out the logs. He did so with such success that not only were cypress logs eventually sold far below their old price but that swamp land which had once brought only \$1 an acre, commanded \$75 per acre. Experts like Mr Miller, trained in technological schools are needed more and more. The American telephone system a marvel of efficiency, is the creation of a dozen engineers whose work is confined entirely to the improvement of telephonic communication They are engaged at princely salaries to meet the needs not only of to-morrow but of the day after to-morrow to devise systems for which there is no immediate use but which will become of paramount importance when a city of two million inhabitants has increased in population by one hundred per cent.

Those who have read the addresses of the recipients of the Perkin medal, awarded for distinguished achievements in chemical engineering, must have been struck with the opportunities that await the trained man in that one field alone. Herman Frasch told how the application of chemical principles enabled him to rid Canadian oils of their sulphur, and thus to make them more generally salable, how he had improved the methods of salt mining and above all, how he had successfully solved the problem of raising to the surface the sulphur buried beneath Louisiana quicksands, after a dozen men before him had failed So, too, James W Gayley, an academically trained metallurgist and a former vice-president of the United States Steel Corporation, showed how, with his dry blast process, he had markedly improved our methods of reducing iron ore.

At the International Congresses of Hygiene, Chemistry and Testing Materials, held last year in this country, paper after paper was delivered bearing ample testi-

many to the achievements of trained men in modern industry, and therefore indirectly proved the opportunities that awaited the technical graduate. Thus, in discussing the production of synthetic rubber by Harries and Hofmann, Prof. Duisberg showed how all the resources, both technical and financial, of a great German chemical company are being used in endeavoring to produce rubber by artificial means so cheaply that the chemical factory can some day compete with the plantation—a work on which dozens of trained chemists have been unremitting ly engaged for years. Prof Bernthsen showed how important has been the aid of the trained chemists employed by the company of which he is the head, in reducing nitrogen from the air, so that the exhaustion of the Chilean nitrate beds, so frequently prophesied, is no longer a cause for alarm. Nearly every one of the papers read before the societies mentioned was prepared by men who are employed by European and American manufacturing companies. They revealed how refined are the scientific methods which are now necessary in carrying out manufacturing processes on a large scale, how hopeless it would be to attain the same result with the aid of men who have not had the benefit of listening to a great teacher in a great technical institution and how increasingly necessary is the employment of the technical graduate in modern industry

Recent Improvements in the Storage Battery

(Concluded from page 247.)

cell consists of electrodes of spongy iron and nickel hydroxide in a caustic soda solution. The caustic soda serves merely as a carrier of ionic oxygen and hydrogen and does not become exhausted, so that impoverishment of the electrolyte is not a serious difficulty, as in the lead cell

In order to increase the conductivity of the active masses, Edison impregnates both the iron and the nickel electrodes with a bismuth compound The bismuth reduces to the metallic state in the iron electrode upon charging, thus forming conducting veins throughout the mass. Estelle, in Sweden prefers to add cadmium Aschenbach uses boron Others have shown the application of the Planté process of electro-chemical formation to these electrodes.

Zinc Lead-dioxide Cell: The substitution of zinc for the spongy lead plate commends itself because of the material increase in voltage. A difficulty lies, however, in the fact that zinc dissolves during discharge, and in being electroplated out upon charge, it tends to deposit in a porous, loosely adherent mass, and so become dislodged from its support This condition necessitates the use of horizontal electrodes, the zinc preferably being in the bottom of the cell Numerous modifications of this type are found, in which zinc is combined with various elements.

Morrison shows a number of screens of woven copper wire *A* (Fig. 1), these screens being silver or copper plated and amalgamated by dipping with mercury Zinc is electroplated upon this support during charge. The upper electrode *B*, separated from the lower one by an insulating plate *E*, may be made of aluminium, copper, silver or nickel. Morrison so proportions the relative quantities of the zinc and the caustic soda electrolyte that only a part of the zinc dissolves, the rest remaining on the support and merely oxidizing. Morrison also has found that the zinc is held insoluble by the addition of cadmium

Other Battery Combinations Perry has a positive pole electrode of nickel and silver oxides, an electrolyte of potassium zincate and a negative pole plate of zinc. A combination of zinc, chromium and mercury for the negative pole plate and mercury and silver oxides for the positive is used by Morrison. He prefers an electrolyte of caustic potash containing chromium hydroxide or a chromate.

Regeneration: The lead sulphate formed in the normal discharge of the lead cell

should remain scattered throughout the plate in a finely divided condition, so that upon charging, it may be readily transformed to the oxide or the spongy lead. When the sulphate collects in large white patches, which are non-conducting, and so remain unchanged during the battery action, the cell is said to be sulphated. A regeneration of such sulphated batteries is accomplished by Luckow, Friedrich and others in the following general manner. The cells are emptied, washed out and filled with water. The acid clinging to the plates furnishes sufficient conductivity. A current is passed through the plates in a direction opposite to that of charging for 4 to 8 days, with a current density of 20 to 50 amperes per square decimeter, until the plates are completely reversed, the oxide to spongy lead and *vice versa*. The current is then passed in the opposite direction for 3 to 6 days more, and finally the plates are charged in the regular acid bath. The electrolyte for this regeneration may be a one per cent solution of potassium or sodium sulphate, carbonate, borate or hydroxide. The last three compounds serve to neutralize the sulphuric acid set free during the process, thus keeping down the apparently objectionable acidity.

Preserving the Electrodes. It is known that lead, zinc and iron electrodes tend to oxidize on drying. This brings a mechanical difficulty into the shipment or care during long continued disuse of such plates. A German patent to Heym states that if the negative pole plate is washed and then dried in a vacuum or in gases that do not attack the metal, it does not oxidize upon being brought into the air.

Separators. The ordinary perforated plates of rubber or celluloid often allow the lead to "grow" through the perforations and bridge the electrical gap. It, therefore has been found necessary, in many instances, to use a porous diaphragm also. Wood is found to be most suitable, but certain impurities, such as acetic acid, resins, vasculose, etc., which are injurious to the lead active materials must be removed. This may be done by treatment with an ammoniacal solution of copper oxide, by oxidation by means of hydrogen peroxide, nitric acid, hypochlorites, etc., or by solution in alkali and alcohol. Marino treats with steam under pressure and then with hydrogen peroxide. Dodge soaks the wood successively in sulphuric acid and potassium hydrate. DeMartis treats a woven fabric in a similar manner, so as to have left only the pure cellulose.

Circulating Electrolyte. Because of the well known limitations of the regulation storage battery, two other theories are being made the basis of experiments: that of circulating the electrolyte around or through the electrode and that of generating current from various exothermic chemical reactions, using inert electrodes. By the first method, the reaction products are forced from the pores of the electrode, either continuously or intermittently. For example, Hite circulates the electrolyte along the face of the plate and through the mass of a suitable depolarizing oxide, made porous by being mixed with asbestos or cement. Benko forces an electrolyte carrying oxygen or chlorine in solution through the pores of a carbon cathode, zinc being the anode. In the lead storage cell, Sokal pumps the acid through the porous walls of concentric cups, which are filled with the lead active materials.

In the other type of cell, which generally would involve the circulation of electrolyte also, a liquid or gas capable of being oxidized reacts through a porous diaphragm with another similar substance capable of being reduced. The energy ordinarily given us as heat in such chemical reactions is thus obtained as electrical energy. Thermo-chemical formulæ will show what E.M.F. can be expected from a given reaction, thus foretelling its practicability. Basset describes as example of this cell, wherein the energy is obtained from the reaction of bromine or nitrous acid upon sulphurous acid in sulphuric acid, both electrodes being carbon. The reaction using bromine, which gives about 0.6 volt, is one of oxidizing SO_2 to H_2SO_4 and reducing Br to HBr.

The structure used by Basset is shown diagrammatically in Fig. 2. Carbon plates *1*, *5*, *9*, *13* are held between insulating frames *2*, *4*, *6*, *8*, *10*, and *12* of celluloid and separated by porous diaphragms *3*, 7, and *11*. The path of one liquid is indicated by the arrows, the entrance being at *H* and the exit at *K*. The other liquid circulates similarly in the other compartments.

There is a wide open field for those working on these last mentioned theories, especially in the use of organic compounds, many of which have high calorific values, such for example as the explosives. As a result of this future progress, we will soon run our cars by electrical power furnished from two tanks or packages containing, as it were, concentrated energy which can be set free in a battery. Even to-day we have a forerunner of this in the use of steel tanks of liquid chlorine or compressed hydrogen and oxygen in the gas battery.

Machines for Printing Railroad Tickets

(*Concluded from page 248*)

gear which meshes with a bevel gear on a main vertical shaft. On this vertical shaft is secured a circular table. Near the edge of the table is a second vertical shaft intermittently driven which operates mechanism for feeding forward a strip of paper and printing thereon the main body of the ticket. The strip of paper then passes over an aperture in the table. A cutting device then descends and cuts off the part required for the ticket, and at the same time the date is stamped on the back. The table is now rotated to bring the ticket under the printing wheel mounted on the top of the machine. This wheel is composed of disks *A* and segments *B* carrying on their peripheries name plates of the various stations on the railway system. The main wheel, as well as each disk, is rotatable which makes it possible to arrange a very large number of type plates in a small compass. The name plate of the station desired is brought immediately over the table, and when by rotation the ticket arrives under the type plate, a plunger rises and presses the ticket against such plate. As the table moves on, a numbering device stamps a serial number on the ticket. For inking the name plate and the numbering plate, an inking ribbon in the form of an endless belt is used between the ticket and such plates. A strip of paper for auditing purposes, carried by unwinding and winding rolls, passes transversely between the folds of the inking ribbon, so that the place of destination and number is printed on such strip for each ticket printed.

In the machines just described, provision is made for numbering all the tickets with one serial number, but in the next machine (Fig. 3) the tickets to each station have their own serial number. In this machine, there is a horizontal axle carrying at the front of the machine a disk *D* having the names of various stations marked thereon, and inside the casing a similar disk carrying on its periphery type plates for printing the names of such stations and occupying the same relative positions as the names on the front disk. At one end of each type plate are mounted numbering disks which are operated each time such type plate is brought into use so as to number consecutively the tickets sold to such station. On the other side of the disk bearing the type plates are located small numeral disks which are operated each time a ticket is printed for the purpose of registering the total number of tickets sold. In order to make up a report of sales, the inventor has provided a web of paper mounted on suitable rolls, and at any time these rolls may be thrown into operation so that the web is impressed against each type plate and its serial number in turn. By this means the [illegible]

The last considerable improvement in these ticket printing machines was the addition of the cash register feature. Such a machine is shown in Fig 4. In this machine the date is first printed on the back of the paper strip, and this strip then passes between an impressing roll 1 and a printing cylinder 2. On the periphery of this cylinder are fixed type for printing the general reading matter such as the name of the railroad, station where sold, conditions of sale, etc., and also a groove for holding the type bar for printing the destination. These type bars are normally carried by spring pins on two endless bands 3 mounted on two drums 4. Mounted alongside the type bar carrier are two sprocket belts 5, one of which passes around a fixed sprocket wheel on the axle of one of the drums, and the other over an idler on such axle. To the first belt is secured a carriage which slides on a rod mounted parallel to such belts. At the front of the machine are arranged several banks of keys similar to a cash register, there being one key for each station, and such keys being arranged in the same sequence as the type bars on the carrier. When one of these keys is depressed, the carriage is made to clamp the second or power driven sprocket belt at the proper place so as to bring the proper type bar opposite the slot in the printing cylinder. At this point the carrier stops and a device grips the type bar and inserts it in the cylinder, which then rotates to print the ticket. When the cylinder has completed its rotation the type bar is removed to the carrier and the carrier is then made to assume its original position.

The end of each type bar is notched in accordance with the price of the ticket to the station, and ratchets or slides are made to move up against this notched end every time the type bar is used. These racks or slides set in motion the mechanism for use in recording the amount of sales. Underneath the registering mechanism, the auditing sheet is made to travel, and each time the printing cylinder revolves, the total of sales is printed on the sheet and a hole is also punched in the sheet opposite the station to which the ticket is sold.

This machine is operated by a weight motor 6, and when the weight is wound up and the desired key has been depressed motion is transmitted intermittently to the various parts of the machine for performing the following operations: the proper type bar is brought opposite the slot in the printing cylinder and transferred thereto, the printing cylinder revolves once, printing the ticket on the upwardly moving strip, the type bar is returned to the carrier and the carrier moves back until the type bars are in their proper positions. While this movement is taking place, the registering disks are advanced in accordance with the price of the ticket and the total amount is printed on the auditing strip. Likewise, the auditing strip is punched in the proper place and the printed ticket is cut off.

A new railroad ticket printing machine which is expected to facilitate the sale of tickets has been introduced on the Prussian Government Railroad. The machine prints tickets to all stations, and the ticket seller has nothing to do but to put a blank ticket form into a slot and to set the machine by means of pushing a carriage so that it will print a ticket as he wishes. The apparatus prints the ticket, also a control slip which shows all the tickets that have been printed and sold. The control over the business the ticket seller has been doing is thereby complete. The printing of the tickets takes less time than the hunting for the ready made tickets in the different pigeon holes, for the ticket seller has nothing to do but to take a piece of cardboard from a heap at his side, to insert it into the slot and to move two levers.

From the foregoing, it will be seen that much thought and study has been devoted to the development of this class of machines, and while the latest types are decidedly complex, they are not unduly so considering the results accomplished. The

inherent difficulties are no greater than those met with in the cash register now of such general use, and there appears to be no good reason why these ticket machines, when once perfected, should not come into general use.

A New Gear Engine

(Concluded from page 249.)

"The advantage of this cycle lies not so much in the cycle itself as in the form of the machine which the cycle permits to operate on it. The engine possesses the same advantages as the turbine over the reciprocating engine in that all of the parts in contact with the steam are at a constant temperature for any constant load condition, and the heat losses due to cylinder condensation in the reciprocating engine are obviated. The engine operates at much higher speeds than piston engines and, therefore, allows the use of smaller and consequently cheaper constructed machinery, such as electric generators, centrifugal pumps, etc. As it uses the pressure energy of the steam instead of the kinetic energy it does not have to meet the difficulties encountered by the steam turbine in dealing with enormous steam velocities which have given no very great trouble with large size turbines, but have rendered small turbines uneconomical."

The novelty of this new system of compounding, when considered in conjunction with the good water rate already obtained by the single-stage unit, furnishes very interesting computations relating to its future possibilities. Mr. Charles H. Clark, the inventor of this gear engine, is not the first to devise a gear engine. Many attempts have been made to produce a practical engine of this type in the past. The most important differences between the Clark engine and other gear engines resides in the fact that the gears A are inclosed at their meshing point by a stationary structure (with sufficient clearance to allow the gear to revolve freely) to direct the fluid against the teeth, but elsewhere they are not inclosed at all except of course by the casing B, which leaves plenty of space for unimpeded movement or expansion of the fluid. Heretofore the inclosure employed has always been either so close to the gear not only at their meshing points, but elsewhere also, that a powerful suction is produced which opposes the rotation of the gear, and hence cuts down the efficiency of the engine, or else the structure including the gears at their meshing points has been so mounted that it can be moved by the driving fluid, the idea being that it will in this way be self adjusting. But this does not work in practice, for it permits wasteful leakage and binding of the parts which should move freely with the least possible friction.

Quite as interesting as Mr. Clark's engine are the accessory mechanisms introduced by the inventor to adapt his engine to practical working conditions. The drawing, Fig. 2, shows a novel speed gear by which the speed of the engines may be reduced 20 to 1. The power shaft G is formed with teeth cut therein, adapted to be engaged by the teeth of six spur wheels H. The spur wheels are arranged in two sets of three, with their shafts arranged in a circle about the shaft G, and disposed sixty degrees apart. These shafts in turn bear pinions which engage a single spur gear mounted on the driven shaft. As the power shaft G is surrounded on all sides by spur gears, practically all of its teeth are in engagement at all times, and there is no thrust to contend with. As each tooth of the power shaft is doing its share of work, the teeth may be made much smaller than would otherwise be required. In the illustration, which is drawn to scale, the power shaft is but one inch in diameter. Yet through this small power shaft 40 horse-power has been delivered at a speed of 3,600 revolutions per minute and stepped down to 180 revolutions per minute at the driven shaft.

The power shaft is connected to the engine shaft with a flexible coupling. The

coupling consists of short spring rods arranged in a circle, something like a lantern gear This flexible coupling permits the power shaft G to find its own axis of rotation. In fact, the power shaft has practically no bearing other than that afforded by its engagement with the spur wheels H The tooth speeds afforded by this system of gearing are one sixth of that now employed in speed reduction gears, and about twice as much work is done the factor of safety being about twice as great at low speed. The gears do not travel over twenty feet per minute

Another interesting development in connection with this engine is a governor invented by Mr Clark The governor can be adjusted so that the speed will either increase or decrease as the load is increased and there is a point of intermediate adjustment which gives constant speed under all conditions The details of this governor are shown in Fig. 3. The balls of the governor are in the form of two sectors J, which engage a rack K, connected by suitable means to the throttle The speed of the governor varies as the radius of the circular path of the ball or weight about the axis of gyration of the governor and as the sine of the angular displacement of the center of gravity of the ball from the plane passing through the pivot of the ball perpendicularly to the axle As both of these quantities are variable Mr Clark has so designed his governor that the variation will be equal through a considerable arc of travel of the weight This he has succeeded in doing by placing the center of gravity of the weight J in such a position that at any given speed the torque or tendency of the weight to swing out varies directly as the displacement of the centers of gravity of the weight from the theoretical neutral position In the Clark governor the fulcrum of the governor ball is 2.5 times farther from the axis of gyration than the distance of the center of gravity from the fulcrum

Bee Insurance in Switzerland

THE latest of the diversified forms of insurance applicable to rural life and industries is the insurance of bees against foul brood, now in successful operation in Switzerland This dread disease, which is due to bacteria of extraordinary vitality is extremely infectious A hive in which it occurs is a source of danger to the whole neighborhood, since it is sure to be plundered by bees from other colonies which carry the diseased honey and comb to their own hives It is, therefore, a matter of great importance to the community that such hives should be promptly dealt with in the usual way the combs removed and burned new combs started and melted down after a few days, and the apiary completely disinfected

In order to minimize the loss in such cases, the Swiss Beekeepers Association decided a few years ago to establish a system of foul brood insurance to be compulsory upon all the members, about 7,000 in number The beekeepers pay a premium of 5 centimes (1 cent) a hive In return for this they are guaranteed free treatment of infected or suspected hives, instruction and assistance in disinfecting, and compensation to the extent of 75 per cent of the value of hives and comb destroyed by the inspectors. As a further means of protecting members, persons who are not policyholders are also aided and were, until recently indemnified for 50 per cent of their losses.

In December, 1909 the Swiss government decided to take over the duty of inspecting and treating diseased hives and the association was thus relieved of much expense Moreover, as all beekeepers are now obliged by law to sacrifice their hives when infected the association has no longer a motive for indemnifying non members and has ceased to do so.

In 1911 the number of hives insured was 105,170 cases of foul brood, 114, and the expenses of the organization, including claims paid, exceeded the premiums by 342 francs—a trifling loss for a mutual insurance society

History-Making Cars

By R. E. Olds, Designer

For 26 years, and in legions of cars, I have written a good bit of motor car history

Reo the Fifth sums up all the results of it. It embodies all I've learned.

This is the latest of my history-making cars And you who would know what time has taught will find it all in this 1913 chassis

Go Deep

Don't follow the trappings of a car

We don't minimize appearance equipment up to dateness One glance will show how highly we regard them

Here's a 17 coated body Here is deep rich upholstering made of genuine leather Here are electric lights comfortable springs nickel trimmings set in dash lights—comfort luxury and room

But those are easy and apparent features Makers dare not skimp them So you must go below these things to measure up a car

Basic Worth

And a new car's performance is no criterion of value Any modern car makes attractive demonstrations

The real question is how that car will perform in five years from to day What will be the cost of up keep and repairs? How will the car meet an overstrain? What troubles will it give me?

The answer to those things lies in the chassis There is where you should look

What You'll Find

In Reo the Fifth you'll find steel made to formula Steel which we analyze twice before using to be utterly sure of its strength

You'll find gears which were tested in a crushing machine of 50 tons capacity

You'll find 2 inch seven leaf springs made from just the center one third of the finest steel ingots Springs which we test for 100 000 vibrations

A $75 00 magneto—

A doubly heated carburetor—

A costly centrifugal pump

You'll find in all driving parts big margins of safety —not less than 50 per cent For all of these parts are tested to sustain a 45 h p engine

Costly Items

Those oversize tires—34 x 4 —cost $60 00 more than tires which some regard sufficient They are put on to double your tire mileage

There are in this car 15 roller bearings 11 of which are Timken They cost five times as much as common ball bearings Yet we might call this a Timken bearing car if we used but two such bearings

We use in this car 190 drop forgings to avoid all risks of flaws Steel castings cost one half as much

Each car must pass a thousand tests and inspections Nothing is left to chance Important parts are all fitted by hand—ground over and over to get utter exactness

Each engine gets five long continued tests three of which are unusual These tests require 48 hours After certain tests we take each engine to pieces and inspect every running part

To insure every precaution with every car we limit our output to 50 cars daily so men are never rushed

As a result every Reo the Fifth goes out a perfect car There are no defects no shortcomings to bother the man who gets it

The Hard Things

These are the things which are difficult and costly They add, I figure, $200 00 to the necessary cost of each car

It took years and years for me to learn their importance And it takes the user years sometimes to find out all they mean

It is easy to add attractions which all buyers see But these hidden things take courage

But all the faith which men have in me rests on this hidden worth Men have come to expect it and they'll always get it in any car I build

And the demand for this car—always twice our production—shows how men are turning to the well built car

One Rod Controls It

One small rod between the two front seats does all the gear shifting in Reo the Fifth The driver moves the rod only three inches in each of four directions

He sits on the left side as in all up to date cars so this rod comes at his right

There are no levers side or center Both brakes are operated by foot pedals So the driver's entrance on either side is entirely unobstructed

This form of control is exclusive with us is one of this car's great attractions It makes gear shifting as easy as advancing the spark

A thousand dealers handle Reo the Fifth. Write for our catalog and address of nearest showroom.

R. M. Owen & Co. General Sales Agents for **Reo Motor Car Co., Lansing, Mich.**

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SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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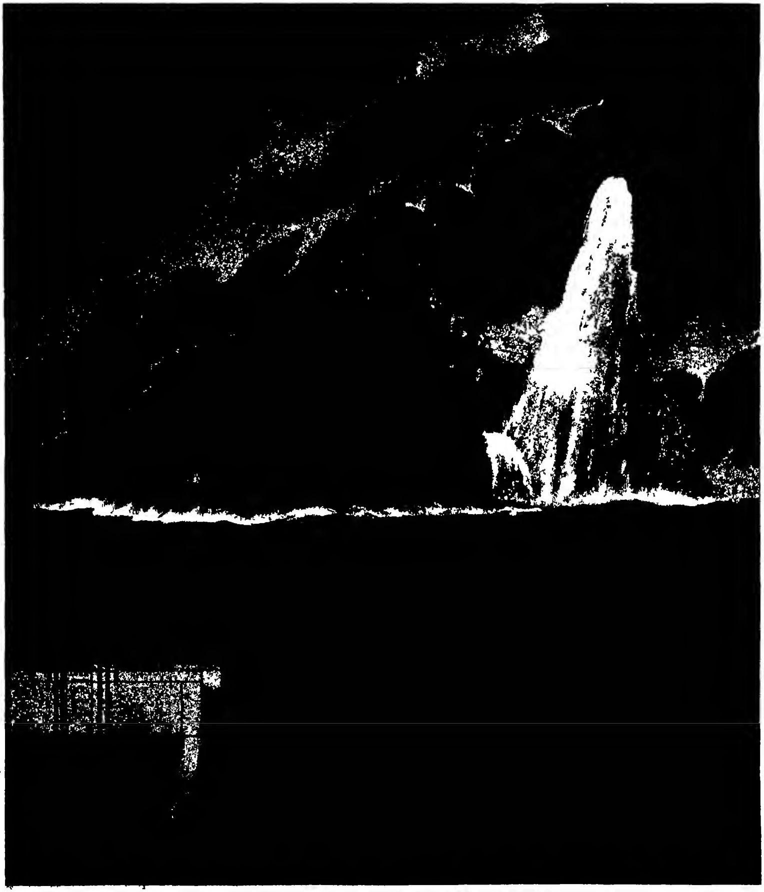

The small sketch shows the new method of expelling water from a warship by the simple expedient of forcing compressed air into the compartment affected

PROTECTING BATTLESHIPS WITH COMPRESSED AIR.—[See page 266.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Control of the Mississippi River

THE volume of correspondence which has reached this office since the publication on February 15th of our editorial on the problem of the Mississippi River proves that the magnitude and pressing importance of this question is appreciated not only by residents of the Mississippi Valley, but increasingly by the nation at large. We believe that before very long it will be understood that the regulation of a natural waterway that flows through the heart of the country is surely of equal importance to the construction entirely outside of our borders, of an artificial waterway such as we have built at Panama.

We draw attention to a letter upon the general subject of Mississippi River control, printed elsewhere in this issue, which draws attention to the fact that those who are interesting themselves in the problem are to be grouped broadly into two parties—the one believing that it is possible to regulate the Mississippi by properly revetted levees, the other holding that the best results will be obtained by a combination of dams for the storage of floods at the head of the Mississippi and its tributaries with a system of levees in its lower reaches.

In the editorial referred to we stated that those who believe that it is possible to control the Mississippi by building vast reservoirs near its headwaters have failed to appreciate the magnitude and cost of such reservoirs and the enormous areas of land that would have to be condemned for the purpose. It was shown that Government measurements, taken at the height of the recent flood, proved that at one particular point the river was flowing at the rate of 2,000,000 cubic feet per second—a maximum flow which is equal to twelve times the amount of water that passes over Niagara Falls.

These figures of total quantities are sufficiently large to prove that the regulation of the river by reservoir construction alone would be impracticable, even if the existing levee system were maintained at the present grade line. As between regulation by carrying the levees to a height that would absolutely control future floods, or building the levees to a lower height and constructing reservoirs to hold back a portion of the flood waters, there is of course a difference in cost and time of construction which could only be determined as the result of accurate surveys and estimates. We do know that the army engineers, with their long experience and a vast amount of accurate data at command, have made an estimate for complete control of the river by levees, of about $70,000,000 for the levee work and about $90,000,000 for the revetment to protect the levees, or a total cost for the whole work of $160,000,000. Whether it would be possible to make any serious reduction in this total by holding back a certain portion of the flood waters is a question upon which it is foolish to engage in any mere guesswork. There is at least a strong suggestion that any reduction in cost so secured would be inconsiderable in the statement of Col. Townsend before the House Committee, that if it had been possible to destroy the whole State of Minnesota (that is, hold back all the water that flows over it) there would not have been a difference of three tenths of a foot in the height of the last flood at Cairo. Furthermore, a reduction of three or four feet in the height of the flood by conversion of the St. Francis Basin into a storage reservoir, would have called for the sacrifice of some seven thousand square miles of country. Nevertheless, we believe it would be good policy to have estimates prepared as to the relative economies in time of completion, benefits conferred, and total cost, of a pure levee system as against a levee-and-reservoir system.

Referring to the statement of our correspondent that in the year 1717 a two-foot levee was ample to protect New Orleans from flood, whereas in 1912 twenty two feet were registered at the same city, we wish to point out that the difference may be regarded as being in a certain sense an eloquent tribute to the industry of the American people, in bringing into subjection the virgin lands of the Mississippi basin. Two centuries ago the melting snows and heavy rains were retarded in their flow from the higher to the lower levels by vast forests and thickly interlaced underbrush which has since been cut down and cleared away, and the flow of surface and subsoil water into the streams has been facilitated by the open ditch and the subsoil drain. It is quite possible that if two graphic curves were developed, one representing the rate of population in the Mississippi watershed, and the other the increase in height and volume of the Mississippi floods, there would be found to exist a surprisingly close relation between the two.

What the Rich Man Might Do for the Scholar

BUILDING libraries is a favorite pursuit of philanthropists. This proves that many benevolent persons prefer to minister to the mental rather than the material needs of humanity, a preference with which we are not disposed to quarrel. Just because, however, we heartily approve of libraries, we deplore the fact that the amount of money spent in creating them is out of all proportion to the amount spent in making them useful. A library is still a library, even though its contents are securely locked up from human sight, as in the case of the precious manuscripts said to be stored in the crypt of St. Sophia, at Constantinople. The admirable science of librarianism which has been mainly evolved within the past half century, has for its main purpose the removal of the invisible bolts and bars that obstruct access to libraries. Modern aids to reading and research, in the form of card-catalogues, indexes, bibliographies, and the like, have immensely facilitated the use of the great collection of books of which our civilization is so proud, but there is still an almost unlimited amount of work to be done in this direction.

Here is a suggestion for the rich man who wishes to vary the programme of library building. A library is primarily beneficial only to a restricted community. The benefits of good work in the bibliography are universal. Why not endow a bibliographic institute?

Gustav de Laval

IN his book "Great Men," Prof. Wilhelm Ostwald makes a scientific study of the life-history of the great scientist as a specific type of man. There is no doubt that such men do represent a specific type, or perhaps rather a number of specific types. Gustav de Laval, whose death was recently announced, was a striking example of the typical inventor, a mind ever busy on the solution of problems, a man who solves problems because he cannot help himself. Thus it came that not all of his inventions proved commercial successes, and those that did, enriched others perhaps more than their originator. It has been estimated that the cream separator and milk tester devised by de Laval have saved billions of dollars to the world's dairy interests. As for the steam turbine, one form of which is known by his name, though the entire field was opened by him, its value to the world needs no emphasis here.

Gustav de Laval was born on May 9th, 1845, in Sweden, though, as his name implies, he comes of French stock, one of his ancestors having settled in Sweden after serving in the host of Gustavus Adolphus. De Laval early showed an inclination for mechanics, and his parents wisely directed his education toward an engineering career. He entered the technological department of the University of Upsala in 1863, and three years later graduated with distinction. Then came a short period of practical experience in an iron mine and with a waterworks builder, followed by a post graduate course at Upsala, leading to the doctorate in 1872. Upon re-entering practical pursuits, he was sent to Germany to make a study of the manufacture of sulphuric acid, and upon his return to Sweden, he built the first sulphur burners in his country. Later he became constructing engineer at an iron works, where he introduced various improvements in galvanizing, the production of steel, and the extraction of phosphorus from iron ore.

The idea of the de Laval steam turbine came to him in the course of an experiment in sand blasting. The breaking loose of a steam jet was the fortunate accident which started the train of thought. An accident, also, it was that led him to his other great invention—the artificial cream separator. There was a large dairy on the iron works estate where de Laval was employed, and so, not unnaturally, the talk one day turned upon a new milk skimmer reported from Germany. It consisted essentially of a rotating barrel, in which the milk was placed. Centrifugal action hastened the separation of the cream, which was finally skimmed by hand as usual. This crude device formed the nucleus of de Laval's automatic centrifugal separator, in which the cream is discharged in a continuous stream from the rotating vessel. Such was de Laval's sense of honor that he refused to sell his invention until he had first given an option to the inventor of its crude prototype. As the latter, however, did not avail himself of this offer, de Laval proceeded independently with his own device.

De Laval was a great inventor, but he was more—he was a man of great character. His patriotism took the practical shape of services rendered to the State as member of the Lower and of the Upper House of the Swedish Parliament. From these activities he retired in 1906, finding that, after all, his best qualifications lay in other directions.

Sweden is justly proud of a noble list of great men, its sons. And in this list not the least is the late engineer and inventor, Carl Gustav Patrik de Laval.

Germany's Aeronautical Weather Bureau

THE first storm warning service for aeronauts on a national scale was that established by the German government at the beginning of the year 1911, as fully described in the article "An Airman's Weather Bureau" in the SCIENTIFIC AMERICAN of July 29th, 1911, p. 98. This unique institution has now been in operation over two years, and has amply justified its existence. Its history up to date is given in the last annual report of the Lindenberg Observatory, at which the service has its headquarters.

Beginning with last year, in addition to the center at Lindenberg, a second central station has been maintained at Frankfurt-on-the-Main. The principal pilot-balloon stations are Aachen, Frankfurt, Hamburg, Magdeburg, Berlin, Breslau, Königsberg and Bremen. These are provided with large balloons, capable of reaching an altitude of from 2½ to 5 miles (according to the size of the balloon) in about 40 minutes. Secondary stations, equipped with smaller balloons, are located at Bromberg, Dresden, Ilmenau, and Weilburg. Reports are also received from the independent aerological stations at Strassburg, Friedrichshafen, and Munich.

The telegraphic reports of upper-air observations received at the two central stations are combined with the ordinary low level weather reports collected at the Deutsche Seewarte, in Hamburg, and enable the authorities to issue twice-daily forecasts which state in very definite terms the conditions likely to be encountered by aeronauts at various levels for a few hours in advance. The forecasts and warnings are telegraphed to all the co-operating stations, and warnings are also telegraphed or telephoned directly to individual aeronauts and institutions that request them and are willing to pay a small fee for this service, in addition to the telegraph tolls.

Probably the most important development of the aeronautical weather bureau since it was established is the system of reporting thunderstorms. At first the attempt was made to utilize the services of a number of the ordinary volunteer observers who report by post to the meteorological institutes. This plan was not successful, as a great many observers did not live near enough to the telegraph offices to send their reports promptly—and delays are fatal in an undertaking of this character. Accordingly, with the approval of the postal authorities, a new corps of thunderstorm observers was organized among the 2d and 3d class postmasters (who are also telegraphers). In 1912 the number of these observers, all of whom give their services voluntarily, was 608. In addition, 18 important offices in large towns, which are the centers of the main telegraph lines running in all directions, report disturbances on the lines indicating the occurrence of electrical storms. The fact that reports from postoffices are treated as "service messages" insures prompt transmission, which is further promoted by the fact that the Lindenberg Observatory has a private wire from Berlin. By these means German meteorologists appear to have solved the important problem of giving aeronauts timely warning of all thunderstorms that enter or originate in the Empire. Most of these storms move in a general direction from west to east, and frequently assume the form of line-squalls, i. e., long zones of disturbance moving sideways across the country.

All the important aeronautical events of the last two years in Germany, including the army maneuvers, have made the fullest use of the new weather service, and it is now looked upon as an indispensable institution.

Engineering

That High-speed Submersible.—The high-speed submersible, of large displacement, designed to fight head-on and "rush" the battle line of the enemy, discharging its torpedoes at point-blank range, has again made its appearance (in print) and this time it is credited to the German navy A 25-knot, 3,000-ton submersible, with curved armored deck, rushing at a battleship across the 10,000-yard range, would be difficult to stop before she came within close torpedo range.

One Thousand Horse-power Diesel Engine.—As an instance of the large powers in which the Diesel engine is being built, we note that two 1,000 horse-power, two-cycle, four-cylinder, Carels-Diesel engines are to be installed in an Arizona mining property and that these engines are to deliver 1,000 horse-power at an elevation of 6,500 feet, the consumption not to exceed 0.48 pound of oil per brake horse-power per hour

Test of an American Diesel Oil Engine—After the publication of so many tests of the performance of European-built Diesel engines, it is interesting to study the records of a 225 horse-power Diesel engine, built by the Busch-Sulzer Engine Company of St. Louis, and tested by Prof A T Scott. The engine had been in service six months, and no preliminary tuning up was attempted The records show a fuel consumption of 10 8 gallons of oil at quarter load, 6.8 at half load and 6.2 at full load, or 0 441 pound of oil per net brake horse-power per hour The thermo-dynamic records based on net useful output showed 17 4 per cent at quarter load, 27.8 per cent at half load and 30.3 per cent at full load The results certainly speak well for American Diesel oil-engine practice

The Needs of the Navy—In a letter to the New York *Times*, the outgoing Secretary of the Navy, George v L Meyer, made a succinct statement of the needs of the United States Navy He stated that the battleship fleet should be maintained with 21 ships in the active fleet and 20 in the reserve fleet. The former should not exceed ten years of age, and those between ten and twenty years old should be placed in reserve We should have four torpedo-boat destroyers for every battleship, in addition to scout cruisers, submarines, supply ships, colliers, and minor auxiliary vessels. The building programme each year should be sufficient to replace those battleships which have reached in each year the limit of twenty years of age.

Piece of Rope Wrecks the "Lusitania."—The "Lusitania" has the telemotor system of steering gear, in which the movements of the steering wheel in the pilot house are transmitted hydraulically to the steering engine, several hundred feet away The falling of a small piece of rope or twine into the rack of the telemotor caused the same to bind and jam the steering gear This took place just as the "Lusitania" was entering Fishguard harbor, and was about to turn to port to avoid a steamer When it was found that the telemotor had jammed, an order was given to reverse the turbines at full speed The strain proved too great for the blades of the turbines, which became twisted out of their proper pitch It was found that over one million blades would have to be replaced, and the cost of the repairs will run up to several hundred thousand dollars.

Dock Commissioner Tomkins on 1,000-foot Piers.—In the opinion of Dock Commissioner Tomkins, no new 1,000-foot piers should be built above 46th Street (as was recently suggested by the Board of Estimate and Apportionment) but all such piers should be built south of the Chelsea district. He states that the cost of rock excavation at the site above 46th Street would, alone, exceed $4,000,000 per pier, and the time for building would be not less than four years. There may be some truth in what the Commissioner says, but we do not believe that either the cost or the time of construction would be so great as he states. According to his statement, a 1,000-foot pier could be built at the lower end of Manhattan Island in two years' time for a cost of less than $1,000,000. We are of the opinion that the piers in the lower section of the river should be built first, but that the site above 46th Street should be secured to provide for future contingencies.

Risk of Torpedo Maneuvers.—The loss of a German torpedo-boat destroyer with sixty-six officers and men—practically the whole complement—illustrates once more the grave risks of night maneuvers, when carried out by these craft in connection with battleships. In the particular maneuver in which the disaster occurred, the group of destroyers, in line abreast, passes through a column of battleships. It requires the nicest judgment of speed and distance to enable the captain of a destroyer to carry his boat through the interval between two battleships, which may be steaming at 15 knots or more, without being rammed. A slight misjudgment may bring the craft square across the bows of the big ship; and this is what seems to have occurred in the case of the recent disaster. The Germans are fond of this maneuver and similar accidents occurred in July, 1912, and in September of last year. These, however, are the risks which must be run if high efficiency in maneuvers is to be maintained.

Science

An Important Change in the Map of Asia has recently occurred. The vast region of Mongolia has ceased to be a part of China, and is now independent The Mongols are chiefly famous in the world's history as invaders and conquerors in Asia and eastern Europe They were vassals of the late Manchu dynasty, but not of the Chinese government, and their separation from China resulted automatically from the proclamation of a republic Their secession from China was aided by Russia, which thus secures a "buffer state" on its Chinese frontier

Vertical Component of the Wind—W Peppler has published the results of observations made at Lindenberg Observatory on vertical air movements, as deduced from variations in the vertical speed of pilot-balloons and sounding-balloons. The average rate of ascent of the balloon for each 500 meters was compared with the average for the whole ascent It was found that an increase in horizontal air movement was accompanied by an increase in vertical movement The author obtains from his observations the important general law that vertical displacements of the air occur from levels of smaller to levels of greater horizontal velocity

A Novel Educational Experiment has been in successful operation for some time at McComb City, Miss, according to a bulletin of the U S. Bureau of Education An arrangement has been made between the school authorities and the Illinois Central Railroad whereby boys may work every other day in the railroad shops and on the alternate days attend the high school They are known in the shops as "student-apprentices" and receive a minimum wage of 12 cents an hour By this plan the boys not only pay their way through school, but at the end of the four-year high school course are able to draw a man's pay at a trade, in case they do not find it feasible or desirable to proceed to the university

C. G S. Units in Meteorology—The vehement discussion that has been going on among meteorologists for about six years as to the desirability of making certain radical changes in meteorological units, especially those used in upper-air research, is likely to culminate at the forthcoming meeting of the International Meteorological Committee (April, 1913) The most important change proposed is the substitution of the "bar" and its submultiples for the units now in use for expressing atmospheric pressure The bar is a pressure of 1 megadyne per square centimeter, and corresponds to a reading on the barometer scale of 750 1 millimeters or 29 531 inches. Barometric readings would accordingly, be expressed in millibars, or thousandths of a bar A dynamic unit of this kind would undoubtedly be convenient for mathematical use in certain physical investigations, but whether its general adoption is feasible or even desirable is a grave question Unless adopted universally—a step that would necessitate the reconstruction of existing barometers all over the world, and the conversion of a colossal body of records tables, etc —its introduction would simply lead to the existence of three kinds of units in place of the two—metric and English—which are now in use (and which are one too many!)

The German Antarctic Expedition, under Lieut Filchner, recently returned to Buenos Aires without having accomplished its chief purpose, which was to land in Antarctica and push into the interior of that continent. After traversing a belt of drift ice 1 200 miles wide, new land was found in February 1912 at latitude 76 degrees 35 minutes south, and longitude 30 degrees west, i e, part of the shore of Weddell Sea, and evidently a southwesterly continuation of Coats Land In honor of the late ruler of Bavaria the patron of the expedition, this land was named "Prince Regent Luitpold Land" (Why not simply "Luitpold Land"? Antarctica is sadly burdened with needlessly long names.) The general course of this land was traced as far south as 79 degrees In latitude 78 degrees an ice-barrier was discovered, extending west from the coast, and was named "Kaiser Wilhelm Barrier" A landing was effected on the barrier and a station established, but soon afterward part of the ice on which the station stood was broken off by a high tide, and the explorers had to regain their ship as best they could The vessel then turned homeward, but on March 9th was caught in an ice-floe, and drifted helplessly until November 26th, when it was finally extricated by blasting During this long drift oceanographical and meteorological observations were carried on Weddell Sea was found to be shallow near the barrier, but very deep (about 17,000 feet) in the middle, and separated from the Atlantic Ocean by a ridge or rise, with a depth of about 3,300 feet. The currents seem to be controlled by the winds attending a quasi-permanent barometric depression overlying Weddell Sea. During the same drift an eight-day sledge expedition was made to the westward in an unsuccessful attempt to find the conjectural Morell Land. The expedition had the misfortune to lose its sailing-master, Capt. Vahsel, who succumbed to heart disease on the outward journey The equipment of the party is reported to be intact, and another attempt to effect a landing in Antarctica will be made next December.

Aeronautics

A New Cross-country Speed Record.—On March 4th the French aviator Guillaux who has recently made new speed records when carrying a passenger, flew in his 70 horse-power Clement-Bayard, all-steel monoplane from Savigny-sur-Blaye to Paris, a distance of 118 miles in one hour, thus breaking all records for speed across country On February 12th he made records of 391 9 kilometers (243 5 miles) in 4 hours, and 410 kilometers (254 8 miles) in 4 hours, 10 minutes and 40 seconds over a 10-kilometer course when carrying a passenger His average speed was more than 62 miles an hour

The St. Cyr Institute—Regarding the Aerotechnic Institute of St Cyr, near Paris which we recently illustrated, the annual report shows that even at the start there were fifty-two demands for tests of aeroplane surfaces and the like, or for information on allied subjects The large laboratories, testing halls and experimental tracks under Prof Maurain's direction are well adapted for this work Among others researches were made upon propellers at various speeds Capt Riviere also tested small models of propellers with the blowing machine Profs Toussaint and Lepere made tests upon recording instruments which are designed to be used on aeroplanes during the flights

A New Altitude Record of Nearly $3\frac{3}{4}$ Miles. At the Bue Aerodrome on March 11th M. Perreyon, on a Blériot monoplane succeeded in reaching the tremendous height of 6,000 meters (19,685 feet) He thus beat the records of Legagneux (5,450 meters or 17,880 feet on September 17th 1912) and of Garros at Tunis (5 610 meters or 18,400 feet on December 11th 1912) by a wide margin The atmosphere is only about half as dense at these great heights as it is at the earth's surface Not only does this affect the lifting power of the aeroplane but it reduces the horse-power of the motor as well, so that it is doubtful if a machine will ever be able to climb to a height much greater than four miles Then too, there is the difficulty in breathing and it will be imperative for the aviator to inspire oxygen

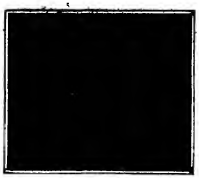
From France to Italy by Hydro-aeroplane—The first hydro-aeroplane trip from one country to another was made on March 4th, when MM Laurens and Schneider, on a Deperdussin monoplane, traveled from Beaulieu-sur-Mer to Genoa in 1 hour and 52 minutes running time or but 5 minutes more than the time made by Garros alone in the Paris-Rome race of 1911 Although the sea was calm, the aviators claim they experienced air holes A leaky gasoline tank caused them to stop at Spotorno, where they were long delayed The flight was started at 8 45 A M, and Spotorno was reached in an hour After resuming the flight at 5 20 P M 40 minutes sufficed in which to finish it despite the fact that from Sestri Ponente the machine was run on the water on account of fog The hydro was moored to a battleship and the aviators received an ovation

Monoplanes vs Biplanes for Military Use—Last year a number of accidents happened to monoplanes at the commencement of the British Army maneuvers with aeroplanes of different types, so that the War Office decided to forbid their use by the officers and at the same time appointed a commission to look into the matter of comparative safety of monoplanes and biplanes as it was claimed that the former were more dangerous The commission has now published its report and it appears that nothing justifies the idea that the accidents are due to any special class of aeroplanes but come only from lack of care in assembling the machines In general, the tests made by the experts seem to show that biplanes are not any more stable than monoplanes, and it is to be remarked that many pilots prefer to use the monoplane as it is simpler and is less fatiguing to handle Several points are recommended which should be looked after in both classes of flyers one of these being an increase in the stay wires so as to give greater strength Landing on the ground should be done gradually and not in a sudden descent, as this is a source of danger

A Height Record—The young head pilot of the Farman School at Etampes, Pierre Gougenheim recently made a brilliant performance breaking the record for height with five men on board in spite of the fact that a very strong wind was blowing at the time At 7 A M the 80 horse-power Gnome-motored Farman biplane left the shed and took on the pilot and four men, and at 7 10 A M the aeroplane started up easily in spite of the heavy load and then made evolutions about the aerodrome At 8:05 A M it reached an altitude of 750 meters (2,461 feet), but then a shower commenced and this prevented him from going any higher He descended under good conditions and alighted on the ground with ease in front of the hangars. The above height was found recorded on the barometer The world's record for five persons had been held by the Belgian Berschaeve with 596 meters (1,955 feet), but this is much distanced at present The flight was checked by the Aero Club's delegate What is remarkable is that the velocity of the wind was 35 miles an hour, and the pilot had great difficulty in overcoming the air resistance caused by the four persons. He used a huge Farman biplane having a spread of 56 feet

How the hood collapses into the frame of the body

The queer, rounded protuberance at the rear serves as a storage receptacle for spare tires.

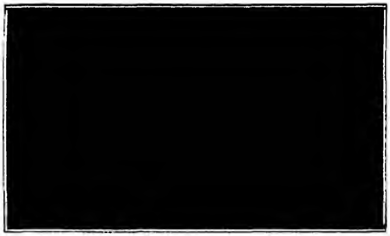


The frame of the hood fits into the lines of the car.

Freak French Automobile Bodies

IN the SCIENTIFIC AMERICAN for March 1st, 1913 we published an illustrated article on some remarkable automobile bodies which have recently made their appearance in France On this page we publish some additional views which will reveal the purpose of the curious bumps and ridges that have undoubtedly attracted the attention of our readers.

The accompanying engravings tell their stories so lucidly that it is almost unnecessary to add any text Suffice it to say that the tendency is becoming increasingly manifest both in this country and abroad to produce automobile bodies which, like the hull of a ship shall be as free as possible from excrescences and protuberances. Tool chests, gas tanks, tire cases and all the other impediments of the running board will eventually be concealed The running board itself will disappear In the Purcat Mery car, the Griffault body has manifestly been designed with this purpose in view The old running board becomes the bottom of a casing in which luggage can be stored Tires are concealed in the rounded protruding rear end of the car The hood is made so completely collapsible that even its frame disappears, becoming or rather literally melting into the lines of the body The head lights become part of the mud guards.



The old mudguard becomes the bottom of a casing for the storage of luggage.

While we cannot altogether admire the car as it is revealed in our illustrations, it would be idle to deny that an important step has been taken in departing from the traditional type of automobile body—a type which as we still manufacture it bears unmistakable evidence of having descended from the old horse-drawn pleasure vehicle

Six Wheeled Omnibus

By Stanley Petman, M E.

WITHIN the past few weeks there has appeared on the streets of New York a motor omnibus mounted on six wheels. The vehicle is similar to those used in the streets of London, which were designed by Henry B Molesworth, the first man to introduce the bogey truck construction in road vehicles. However, the New York omnibus differs from Molesworth's in several important respects.

Molesworth's principal object was to obviate side-slip which up to the time of his invention had been the bane of the manufacturer's life due probably to lack of experience in the construction of heavy vehicles and also in part to the peculiar work for which the 'buses were intended. In this new vehicle the reduction of side-slip has been made a secondary object and follows as a natural result of the greater tire surface in contact with the road. The prime consideration was to increase traction and reduce vibration.

In Molesworth's omnibuses there are three pairs of wheels, one pair being at the front as usual, and the other two pair being at the rear, the arrangement was much the same as that depicted in the accompanying picture. There is this difference, however Whereas Molesworth drove only the center pair of wheels and steered with both of the other pairs, in the latest arrangement both the rear pairs of wheels are driven and the vehicle is steered by the front ones only Which arrangement materially simplifies construction as a matter of course, for it eliminates the necessary complexity which must arise when any attempt is made to steer the two outside pairs. Incidentally, it cheapens construction while at the same time permitting a higher factor of safety due to the better disposition of the metal and the absence of the multifarious joints otherwise necessary

The new vehicle is standard with the exception of its rear axle, which, as may be seen, really is two rear axles, carrying two pairs of wheels. These two axles, however, are very short, being scarcely more than stubs, and are mounted at the ends and integral with what are termed "equalizing bars," the latter being hinged to the main axle which extends the width of the vehicle. The "equalizing bars" are in effect levers of the second class, whose arms are of equal length and partake of the functions of these devices, which is to say, when one end of the lever is elevated, as is shown in the accompanying picture depicting the vehicle with one pair of the wheels on the road surface and the other pair on the curb, the total vertical movement transmitted to the main axle is only half that sustained by the end of the lever The net result of the arrangement, of course, is that a great amount of vibration due to irregularities in the road surface is eliminated.

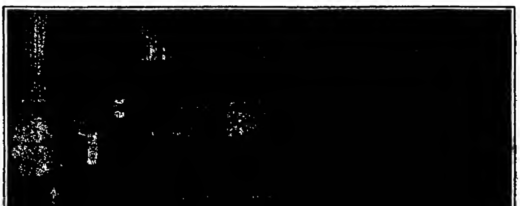
View showing chain connection of the two pairs of rear wheels.

Flexibility shown by backing the rear wheels upon the curb.

The drive is transmitted from the engine through the intermediary of a master clutch and an orthodox gear set to a jack shaft and thence to the front pair of rear wheels through side chains. From the front pair, side chains transmit the drive to the rear pair As both pairs are equipped with brakes, the brake capacity is double.

The inventor claims that as the two pairs of wheels are smaller individually than would be the single pair, the added cost is purely nominal and need not exceed $100 This, it is pointed out would be more than offset by the saving in tires, because twice the surface is in contact with the road as would be with the ordinary vehicle.

The second objection is based on the difference in direction of the pairs of driving wheels when the vehicle is turned sharply But as the distance between wheel centers is short—in practice it is 25 inches—the actual amount of difference in direction is small at best and is more than compensated for by distortion of the rubber tires.



Six-wheeled motor omnibus recently introduced in New York.

Stereoscopic Views of Lightning

By the Berlin Correspondent of the Scientific American

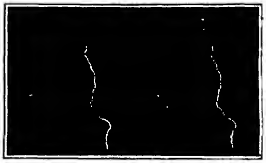
IN the year 1887 the Royal Meteorological Society of England addressed a circular to photographic societies and individual photographers throughout the world requesting them to furnish the society with photographs of lightning flashes. About sixty photographs were secured, and an examination of them made possible the first accurate classification of the forms of lightning. In 1889 Mr Marriott, assistant secretary of the society, published a set of rules for photographing lightning. The same year Weber, in Germany, and Hoffert, in England, independently devised a method of analyzing a compound lightning flash, viz., by the use of a camera revolved slowly in a horizontal plane. This was an immense improvement upon the non-photographic methods—entailing the use of various forms of the revolving disk—which had led earlier investigators including Arago, Dove and O. N. Rood, to conclude that many lightning flashes are multiple and had enabled them to form a rough idea of the intervals between the successive discharges along an identical path which gives such lightning a flickering appearance. Moreover, in 1889, A. W. Clayden, in England, cleared up the mystery of "black flashes" in lightning photographs by his discovery of the "Clayden effect."

Since 1889 the progress of lightning photography has been due chiefly to improvements in the technique of the moving camera. One of the pioneers in this field was A. Larsen, whose work has been done under the auspices of the Smithsonian Institution. (A full account of Larsen's researches was published in the SCIENTIFIC AMERICAN SUPPLEMENT No. 1635, May 4th, 1907.) The most successful applications of this method, however, are due to Dr. B. Walter of Hamburg, who has made comparative studies of lightning flashes and analogous electric discharges in the laboratory. The greatest improvement introduced by Walter in the photographic process was the addition of a stationary camera, installed alongside the moving camera. A comparison of the two pictures thus obtained enables the investigator to determine the exact relation in time of the various phenomena photographed. The first account in English of this double-camera method and its results is that given in Mr. C. F. Talman's article "New Ideas About Lightning" in the SCIENTIFIC AMERICAN of June 29th, 1912. (The reader should examine especially Fig. 2 of the article just cited in connection with what is said below about the use of the moving camera.)

Walter's latest achievement involves the use of a third camera, as stated below. The photogrammetric method in lightning photography is not altogether new; it has been applied by McAdie, in this country, among others. Its use in connection with the moving camera, however, represents an important advance. To complete this hasty sketch of the history of lightning photography it may be added that the feat, once deemed impossible, of photographing lightning flashes in the daytime was achieved with remarkable success last summer by A. Steadworthy, of Ottawa. Moreover, the present writer has seen the negative of a still earlier photograph of daytime lightning, by L. Gimpel of Paris, made by *color photography*. Lastly, it should be stated that there is still a great deal of work to be done in lightning photography, and any competent person who takes this subject up is likely to be rewarded with some interesting discoveries. Several peculiar forms of lightning have not yet been photographed. Beaded

(Concluded on page 275.)

Fig. 1.—Stationary stereoscopic camera.



Figs. 3 and 4.—Stereoscopic pictures of lightning flash taken by two stationary cameras.

Fig. 2.—Movable camera with clockwork.

Fig. 5.—The same flash taken by a movable camera.

"The Snow of the Penitents"

By C. F. Talman

THE traveler in the higher Andes of Argentina and Chile is sometimes greeted with the startling sight of what appears to be an innumerable throng of kneeling white-robed figures upon the barren mountain side. The nearest known human habitation is scores of miles away, the region to which the traveler has penetrated is one in which, on account of altitude, a polar climate prevails, and mountain sickness afflicts even the hardy pioneer. In short, no more unlikely spot could be found for the orisons of this fantastic company.

Closer inspection dispels the mystery—only to replace it with another. Each of the figures is found to be a block of snow or ice but wrought into forms such as are hardly assumed by frozen water in any other part of the world. The resemblance of the figures to human beings engaged in some solemn religious ceremony has led the natives of South America to call these strange hummocky snow fields *la nieve de los penitentes*, "the snow of the penitents"—an expression that is often shortened to *nieve penitente*. The Germans, with their characteristic aversion to exotic terms, have translated this name to *Büsserschnee*, but English writers have been contented with the Spanish form.

How does Nature fashion these grotesque figures? And why are they found only in a limited region of the Andes? These questions have not yet been satisfactorily answered.

The *penitentes* occur only in low latitudes, hence under a sun that is almost vertically overhead at least part of the year. Perhaps it happens that a sheet of new fallen snow is of uneven density; then the powerful solar rays will speedily form depressions around the denser spots. As the snow continues to melt the water trickling down from the mounds helps to deepen the hollows, as it is prevented from accumulating in the latter by the slope of the mountain. The arrangement of the figures in regular rows is also explained by the slope, the water all draining in one direction.

Perhaps the first impulse to the formation of mounds and hollows is given by the wind, which, as everyone must have observed, often blows the surface of a field of snow into waves and ripples.

There is another possible explanation. A well known experiment of Benjamin Franklin was to lay bits of cloth of various colors upon the snow on a sunny day,

Foot of Mount Tupungato.

Pelleras I Glacier

Rio Blanco Valley

The "Snow of the Penitents" (Nieve Penitente) of the Chilean-Argentine Andes.—(Photographed by Dr. F. Reichert.)

he observed that the cloth soon became heated and sank into the snow, the darker-colored pieces sinking more rapidly on account of their greater power of absorbing solar radiation. Patches of dust would have the same effect. Dust is found even on the highest mountains, most of it probably coming from the disintegration of the meteors which are constantly entering our atmosphere from outer space. The wind might easily blow a layer of this dust into a sort of checkerboard pattern and then it would, when heated by the sun, honeycomb the underlying snow. Pinnacled snowfields arising from one or another of these processes are found not only in the Andes, but in the Alps and the Himalayas and probably elsewhere. However travelers who have seen the *penitentes* claim that they are quite distinct in appearance from the snow hummocks seen on other mountains, in which case they must be conditioned by some local peculiarity that has not yet been explained.

The photographs accompanying this article were taken by a leading authority on *nieve penitente*, Dr. F. Reichert, of the University of Buenos Aires.

Compressed Air as a Protection for Battleships

By R. G. Skerrett

THE serious consequences of a stumble upon a submarine mine, the chance, perhaps, of having one of our superdreadnoughts placed pretty nearly *hors de combat* by a single subaqueous blow, led our naval authorities to undertake a novel experiment more than a year ago. That experiment constituted the equipping of the armored cruiser "North Carolina" with a self-contained salvage outfit by which compressed air was to serve as the medium by which the inrushing sea water could be quickly driven outboard again and the damaged compartments substantially drained a few moments after an accident.

The test equipping of the "North Carolina" has proved so satisfactory in a number of ways that this system is to be installed henceforth as a regular feature upon the mightiest ships of our battle line, and this is especially the case with the peerless "Pennsylvania."

Mr. W. W. Wotherspoon is the engineer inventor of this system, and this application of it is really the outcome of his work in connection with the last effort to salve the cruiser "Yankee." The prime idea of the scheme is to turn each watertight compartment into a caisson, as it were, and by the admission of compressed air first to push the water out from the wounded chamber and then to keep it out by a sufficiency of compressed air. In other words, each compartment becomes like an inverted tumbler in a bucket of water—the tumbler being filled before inversion. Then by forcing air in through a hole in the bottom of the glass the water is expelled. In the case of a ship, however, the water enters by a wound in the bottom plating through one cause or another, and steps must be taken immediately to offset the stresses of this leakage before the gathering pressure ruptures the confining bulkheads. By the ordinary procedure, the ship's pumps try to hold the invading water in check, but not infrequently, this is tantamount to trying to pump out the whole sea. Even so, the dividing walls of steel may slowly yield and the vessel is frequently doomed.

By Mr. Wotherspoon's system, not only is the inrushing water forced outboard again but the surrounding bulkheads are given immediate and temporary support, which effectually localizes the injury. He accomplishes this by putting his heaviest air pressure immediately in contact with the water to be expelled, next he surrounds the injured space with air of lower pressure and, finally, he takes the excess of pressure from these supporting compartments by admitting air of still lower pressure to other flanking and superposed compartments. Thus by a successive distribution and reduction of the tax none of the bulkheads or decks is overstrained. This idea of dividing the internal body into succeeding layers or strata of compressed air is one of the unique features of the system. For all ordinary contingencies, the highest pressure would not exceed 14 pounds to the square inch, and the lowest pressure would be in the neighborhood of about 4 pounds to the square inch. We have shown in the small diagram two strata of different pressures and have marked them 1 and 2.

At first blush it may be imagined that the installing of a system of this sort would involve a goodly increase of weight and much additional apparatus. As a matter of fact, the whole equipment is remarkably simple and easily put in place. This is because Mr. Wotherspoon has taken advantage of other fixtures that are already a part of the modern fighting ship. Every compartment is provided with two lines of piping: one to force fresh air into the space and the other to provide an exhaust for the foul air or gases. These pipes have to be strong enough to withstand certain pressure limits, and these limits are considerably in excess of Mr. Wotherspoon's requirements. He merely takes such of these pipes as he may need and connects them to a supply of compressed air. Pretty nearly every man-of-war—certainly all of the big ones—have air compressors aboard for other purposes, and a reserve can very easily be stored in a suitable reservoir and at a very high pressure. Therefore, all that is necessary to meet an emergency is to connect the ventilating pipes of any of the compartments with the compressed air in reserve and then to start the compressors in order to maintain a further supply. The facility with which a flooded compartment can be drained and the pressures in the supporting spaces brought up to the proper degree has been convincingly demonstrated in actual service, both in cases where the flooding has been intentional and where a leaky sea valve has produced the trouble.

According to the building specifications, every watertight compartment of a fighting ship is supposed to be tested at some time during the course of its construction, but because of the complex get up of these craft and the early installing of some of the mechanisms, it is practically out of the question to flood these compartments. Accordingly, these spaces which should be watertight are sometimes not so, and the fact is not realized until accident perhaps reveals that disturbing fact. This is not all. The seatings of watertight doors become imperfect by use, and the extent of this weakness is frequently overlooked, and leakage might be of grave measure should the contiguous space be inundated. Mr. Wotherspoon's salvage system provides incidentally an effective means of testing every compartment and every watertight door at any time, and makes it possible to do this without damage to the contents of any of these spaces. The practical value of this inspection agency has been amply demonstrated, and it is helping our builders to do their work more intelligently and more thoroughly. In a number of cases where flanking compartments became flooded, compressed air was turned into neighboring spaces filled with valuable stores, and the water held away effectually.

A logical development of this safeguard against the foundering of a wounded ship is that of suppressing or smothering fire. For such a contingency, Mr. Wotherspoon again makes use of the ventilating piping, but instead of forcing compressed air into the endangered division, he pumps down through the pipes a volume of non-inflammable gas. Carbon dioxide has been tried for this purpose before, and this has been drawn from the smokestack, but this is not desirable, and in fact is not sufficiently available in quantity in the cases of oil burning craft. Therefore Mr. Wotherspoon will use another gas which can be quickly generated in large quantities. This gas will not damage stores or merchandise. The advantage of a check on fire of this nature must be fully apparent and one can easily see the losses thus avoided instead of using water. Apart from this, water is not always an effective extinguisher, whereas a suitable non-inflammable gas is when made to fill a confined space wherein there is a fire. The suppressing of fire upon a man of war is pretty nearly as vitally important as that of promptly arresting a leak, in fact, there are times when this may be a matter of desperate concern.

Revelations of the Boston Automobile Show

NOW that the last of the really big automobile shows is over, the doors of the annual Boston exhibition having been closed this week, and manufacturers at length can draw breath free from the apprehension of show cares, it is meet to take stock of affairs by way of ascertaining if possible just wherein the benefit of such expositions lies. Probably the true state of affairs never will come to light, though an extraordinarily clear vision scarcely is needed to see that the automobile show as a show has almost, if not quite, outlived its usefulness.

It long has been known that these annual functions cause unrest in the bosom of the manufacturer. Similar symptoms in the bosom of the dealer are only rendered less acute by the hope of increased sales—some day. To the dealer, however, that some day does not come now as it did in the past, it does not come of shiny cars exhibited together under a common roof where the human spirit of restlessness and curiosity induces constant search for something newer to look at or to occupy a mind already cloyed with too much newness and too much gloss. Cars are not sold that way now.

It is a comparatively well known fact, to salesmen at least, that satisfactory sales from his own point of view and from the point of view of the purchaser demand comparative quiet, freedom from blaring bands and a more suitable atmosphere than that afforded by the automobile show. Hence, the dealer does not, as a rule, hail the show with delight. It disrupts his sales and service forces, just as it disrupts the sales and engineering forces of the manufacturer. As a matter of cold fact, it was only after heated argument, and as a measure to prevent unscrupulous promoters stepping into the breach that would be left, that it was decided to hold the usual shows in 1914. Whether they will be repeated in 1915, which is quite a long way to look ahead, remains to be seen, but if present sentiment can be taken as an indication, the repetition is unlikely.

The public wants the shows, of course. They furnish excellent excuses for the display of the family jewels and permit practice in polishing up the manners that go with manifold social doings. But the car-buying public cares naught for such things in the majority of cases. Hence, the influence of the automobile show in increasing sales is questionable, to say the least.

Similarly, as exhibitions pure and simple, the shows which logically are for the exploitation of new wares fall far short of the average expectation. Cars which are shown already have been on the market for several months in nine cases out of the proverbial ten and little—very little—actual novelty is revealed. At the Boston exhibition, for instance, there were just five brands of cars out of a total of some hundred makes on view that had not previously been shown either in New York or in Chicago. Two were gasoline propelled, two were electrics and one was a steamer. It is almost the last of all the steamers, by the way, and its continuance in these days of steadily increasing efficiency is all the more remarkable by reason of the fact that its engine consists of two simple cylinders and that no condenser is used.

In the realm of accessories, the Boston show was no more productive of newness than it was in the realm of complete cars. Two engines appeared, heralded as being new, though in both there was apparent plain indication of well known principles. In one the valves are in the form of reciprocating crescents outside the cylinders proper, and in the other the usual poppet valves are replaced by longitudinal rotating sleeves which alternately cover and uncover cylinder ports. In neither, however, has the designer given evidence of deep thinking with regard to the likely effect of unequal cylinder distortion due to the presence of irregularly shaped castings with comparatively large masses almost directly at the spot where the greatest heat is generated.

The single really significant feature of the show was in the form of a magnetic gear shifting device with which one of the cars was equipped. Pressure on any one of a series of five buttons, corresponding with the four forward speeds and one reverse speed, permitted any of the gears to be enmeshed without further exertion on the part of the driver than the release of the clutch. In view of the widespread adoption of electric lighting and engine starting devices and the general tendency toward the elimination of manual work, the presence of this device may well be viewed as significant, particularly inasmuch as it now is pretty well established that at least one well known American car will be equipped with a device of the kind before the end of the present year.

The Current Supplement

THIS week's issue of our SUPPLEMENT brings the concluding instalment of Mr. Wadsworth's report to the Inventors' Guild.—Much time may be saved, and efficiency gained, by employing judicious methods in sketching machine designs preparatory to the execution of complete drawings. Mr. Ford Harris gives our readers some valuable hints in this matter.—Dr. E. J. Russel of the Rothamstead Experiment Station, gives us a survey of the present views regarding the effect of soil sterilisation upon plant growth.—Mr. F. I. Coleman tells us how the Hwang Ho, the world's most treacherous river, which has changed its course nine times in 2,500 years, has been recently spanned with a railway bridge.—Mr. A. S. Neumark contributes an excellent article on Peroxides and Persalts.—Mr. E. Oberg, in a richly illustrated article, describes the process of wire drawing.—Mr. F. Carnegie reports on a study of the vibrations of rifle barrels carried out by the aid of instantaneous photography.—Dr. R. C. Osburn gives us an interesting talk on the Crayfish. It is not generally realized that this crustacean has considerable food value, yet the annual catch in the United States amounts to $34,000.—An Extract from Lloyd's Official Report for 1912 will interest those of our readers who follow the development of the world's shipbuilding.—A comment on the Friedmann treatment for tuberculosis should prove of timely interest.

Old Tires Make Successful Splashguards.—As the result of a series of splashguard trials which recently were held in Paris, it is interesting to note that some of the most successful devices employed were merely old outer casings split and fastened to the rims of the wheels. On the whole, the tests served to make plain that splashguards arranged to control splashing to a fore and aft direction were most efficacious in protecting pedestrians.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Buggy as a Destroyer of Roads

To the Editor of the SCIENTIFIC AMERICAN

Mr Arthur C Brady is in the right in his article in your issue of January 18th, 1913

I have made the same observation during many years, being led to do so by my work as a teacher of surveying and engineering

Horses do most damage to the roads, and narrow steel tires come next Any gravel or stone road in Indiana bears evidence of the above Unless the former is dragged in suitable weather, which may not occur during an entire season, it soon has three deep grooves, two for the wheels and one midway between, formed by the horses, driven single The last is most difficult to control. It is due mostly to rapid driving On hills, where the horses walk, it is not formed

Our farmers complain of automobiles ruining the roads, but the man in a buggy, with his fast-stopping horse, is a greater menace There would be greater complaint if in taxing vehicles to raise a road fund, the horse-drawn buggy should be given its just share, and speed limited to four miles per hour, a rate that would do but little damage to the road So far as I know, that has not been done in any State The autoist is taxed because they think he is able to pay In most cases he is also willing, greatly to his credit While that is true, the facts as to road wear ought to be understood C A HARGRAVE

Danville, Ind

Spring Wheels

To the Editor of the SCIENTIFIC AMERICAN

Referring to article by Mr Domis which appeared in your correspondence column in the issue of March 1st, I wish to state that it was my intention in my previous communication to point out a principle which must necessarily be involved in any spring wheel, whatever may be its construction

Mr Domis's statement that "the highest type of spring wheel requires all of the springs to assist equally at all times in carrying the load" is correct But it is evident, if we consider any given spring, first in a position below the hub and second in a position over the hub, that the flexures of the spring in the two positions must necessarily be in opposite directions, and of amounts equal to the flexure produced by the load, thus giving a normal flexure in each direction at every turn of the wheel

The normal load flexure and the shock-absorbing capacity of the wheel will each be inversely proportional to the strength of the springs It therefore follows that if "when the wheel is operated over a perfectly level road the springs are not flexed in the least degree," then the shock-absorbing quality of the wheel has been reduced to a minimum by the great strength of the springs.

The question involves a mechanical principle on which I had hoped to obtain an unbiased opinion, more particularly as to whether the present high quality of spring steel was capable of withstanding such a great number of flexures. G F FISHER.

Plainfield, N J

Machining Granite Blocks

To the Editor of the SCIENTIFIC AMERICAN

In the correspondence column of the February 22nd issue there is a request that you call the attention of the inventors of the country to the need of a machine to make granite paving blocks, and in acknowledging it you state that "it should not be difficult to devise suitable machines for doing this work"

After years of experiment with different machines, that failed to do the work in competition with hand labor, we certainly would be glad to hear of any such machine and could use scores of them Further than that, any plan presented that seems feasible we would consider and would finance the construction of such a machine and pay liberally for its use.

We would appreciate the name or names of any firm, inventors, or otherwise to whom this proposition might appeal, so that we could take the matter up with them direct.

Chicago, Ill. WISCONSIN GRANITE COMPANY,
Per WATEN S. PRIMLEY, Treasurer.

Shaping Granite Cubes

To the Editor of the SCIENTIFIC AMERICAN.

In your correspondence column, February 22nd issue, page 174, headed "Required, a Machine for Shaping Granite Cubes," I read something that seems simple.

In 1900, at Providence, R I, I saw a planer similar to that used in the machine shop for planing metal planing granite slabs with a tool also similar to that used on the same kind of planer in the machine shop A pipe with water coming out of it moistened the tool, drop by drop, as the stone passed slowly beneath In another part of the shop a granite column was being turned in the lathe I would suggest that the work could be done just as readily on cubes as on slabs, and that the job would depend upon the speed used only I would also suggest that the job could be done in an economical manner on the ordinary machine-shop profiler or vertical milling machine with a fly cutter This would be faster than the planer, as no time is lost in the return motion The fly cutter is made up of a disk having several inserted tools, which may be removed when necessary to grind The disk turns in a horizontal plane The cube could be held in the ordinary vise chuck, and a stream of water or oil used to keep the tools cool The speed should be no faster than what the tools will stand, the depth of cut and feed would be determined by the breakage of the particles of stone A faster method yet would be to use a vertical grinding machine or surface, as used in the machine shop, using a very coarse wheel It would then be a simple problem in abrasives, which the Norton Emery Wheel Company of Worcester, Mass, could no doubt solve for you in a very few hours

Pittsfield, Mass. ALAN A MCALLAN

Audible Railway Signals

To the Editor of the SCIENTIFIC AMERICAN

In regard to the matter of an "Ideal Automatic Train Control," on which a correspondent writes in your issue of February 15th, I would like to suggest that as to avoiding passing a signal set at danger, the absolutely certain method of invariably precluding this (so long as the block system is in order) is very simple indeed, namely, instead of visible signals have audible ones, for instance, instead of an arm being thrown into a certain position at the side of the track, arrange a trip in the track, which when set at danger, automatically would ring the bell of the engine, or a special one for the purpose, or blow the whistle in some peculiar way, say a half-minute-long blast, so that not only the engineman but the conductor and other trainmen, as well as passengers, could plainly hear the danger signal, and if the train was not immediately slowed down to a "walk," or stopped by the engineman, the conductor or some one else on the train would be sure to see that the train was soon slowed down in obedience to the signal, for "self-preservation is the first law of nature"

Such an audible-signal system could probably be installed much cheaper than an automatic-stop system, which must necessarily be complicated and expensive and would therefore never be generally adopted, and which is open to various other objections, such as sometimes stopping a train with dangerous suddenness at a turn, causing excessive 'wear and tear,' getting out of order too easily, etc Some objections to the present visible-signal system are, that they cannot be seen at all in a heavy fog, the enginemen get tired of looking for them, and it has been proved that there are times when a person with ordinarily good color-sense is unable to distinguish red from green because of a severe cold, lack of sufficient sleep, ill health, or other causes for the brain not acting clearly None of these objections, however, apply to the audible-signal system, which must eventually be universally adopted, and it is strange indeed, that it has not been preferred long ago A simple, inexpensive form of it could be made that would ring a bell electrically (but preferably intermittently) in the cab of the engine, thus dispensing with the mechanism operating a block-signal arm or a trip at the track-side, and of course the less expensive a signaling system is the more generally will it be used Every mile of railroad track should be provided with audible danger signals - the only efficient ones, and in this age of invention there is really no more need of having railroad collisions than for doing without railroads altogether In conclusion, the present visible-signal systems could doubtless easily be changed to audible.

Livermore, Cal. ELMER G STILL.

[Many of the existing automatic-stop devices are equipped with means for sounding an audible signal in the cab —EDITOR.]

Alternative Propositions for Control of the Mississippi

To the Editor of the SCIENTIFIC AMERICAN

Recently you printed an editorial in support of levees as a method of flood prevention and in opposition to anything else. Beyond the shadow of a doubt that editorial created a wrong impression among some of your readers, and for that reason I ask that you print this statement of fact in order that the issue involved be made clear.

Two schools of thought and two sets of men are now engaged in an effort to induce the Federal Government to solve the flood problem

One set—the old-school thinkers—are domiciled at Memphis under an organization entitled 'The Mississippi Valley Levee Association

The other set—the new school thinkers—have been for more than a year domiciled at New Orleans under an organization entitled the National Reclamation Association,' which was formed as the National Irrigation Association" in June, 1899—nearly fourteen years ago

According to Mr John Fox, secretary manager of the Mississippi Levee Association which is advocating a continuation of the 'Levees Only' policy, his organization has secured the enthusiastic support of all the railroads interested in flood protection"

The National Reclamation Association, which is advocating the nationalizing of the river by the Federal Government, and the control of its floods by the Federal Government through the building of levees and revetment of caving banks, supplemented by the control of the source streams in order that levee-breaking floods will no longer be permitted to form, has enlisted in support of its campaign more than 1,000 business men, manufacturers and taxpayers, but no railroad or corporation affiliated with the power site promoters, is contributing to or in any way helping, the work of the National Reclamation Association

In the Salt River Valley of Arizona, the Federal Government has constructed the great Roosevelt Dam, which gathers the freshet waters of the Salt River, conserves them and uses them to irrigate the arid lands of a large territory Below the dam the Salt River is now peaceful and quiet The Roosevelt Dam is an illustration of the character of source stream control provided for by the Newlands River Regulation Bill and advocated by the National Reclamation Association

Down in the Lower Mississippi Valley near Vicksburg Mr John M Parker has named his great 16,000-acre estate the Roosevelt Plantation In May 1912 through the breaking of the Salem levee this estate was turned, by the river into a mighty reservoir with enormous loss to the owner and to many other owners of land in an area hundreds of square miles in extent

The Roosevelt Dam Reservoir in the Salt River Valley is an illustration of a source stream reservoir the Roosevelt Plantation Reservoir in the Mississippi Valley, is an illustration of a crevasse reservoir which the river makes for itself when the floods are uncontrolled at their sources.

Under the terms of the Newlands River Regulation Bill, its appropriation and working machinery are supplemental to not substitutes for levee work provided for or to be provided for through the Rivers and Harbors Bill

During the Congress just terminated six million dollars were secured for the Mississippi River between Cairo and the Gulf

The lowest estimate yet made of the cost of leveeing and revetting the banks of the Mississippi between Cairo and the Gulf under the standard of the Mississippi River Commission is \$140 000 000

Should the "levees only' people succeed in getting the \$40 000,000 asked for by Senator Ransdell, \$100 000,000 additional would be required under the estimate, to complete this one angle of the work an angle which deals with effect and not at all with cause

The Newlands Bill provides this additional \$100 000 000 and it also provides enough money to largely control the flow of such tributaries as the Ohio and the Missouri by controlling the source streams of these tributaries, in this way conserving much of the now wasted freshet waters and turning them to use for industrial purposes, and at the same time aiding materially in checking the formation of great levee breaking floods

In 1717 a two-foot levee was ample to protect New Orleans from floods.

In 1912 twenty two feet were registered on the river gauge at New Orleans.

During these two hundred years the valley has known no protection against floods other than that supplied by levees which invariably broke in some places whenever the increasingly great floods were poured down on them by the tributaries above

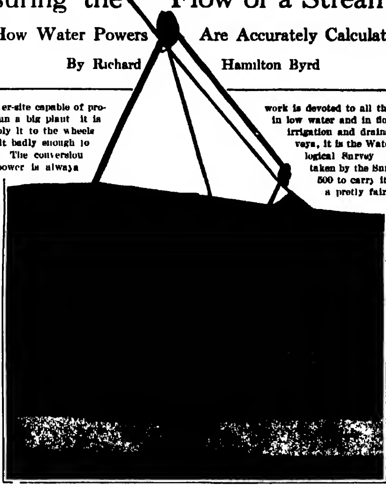
Nobody down here is opposing levees, but many people down here have awakened to the fact that levees alone will not keep the river off the farms, and they are now asking that the Federal Government not only build good levees and properly revet the caving banks, but that it supplement this protection by harnessing the source streams wherever possible, thereby in part at least, reducing the volume of floods by using some of the now wasted freshet waters for the creation of hydro-electric power, for the irrigation of dry lands and for the feeding of the streams in the dry season in order that there will be water on which to float boats. WALTER PARKER.

Measuring the Flow of a Stream

How Water Powers Are Accurately Calculated

By Richard Hamilton Byrd

IT is one thing to own a waterfall or a power-site capable of producing sufficient hydro-electric power to run a big plant. It is another thing to develop this power and apply it to the wheels of industry or to find some one who wants it badly enough to pay the owner what he considers it worth. The conversion of falling water into cheap merchantable power is always a large and most expensive undertaking. It is true that certain large corporations have of late years been acquiring water power properties of great extent, but that the major portion of the water power that can be generated in the United States is controlled by a few individuals or combinations, as has been freely stated, is not to be credited. The power which is at present running to waste in the navigable rivers alone of the United States, which are of course controlled by the Government, is much greater than all the power that has thus far been developed or projected, to say nothing of the millions of untouched horse-power in the rivers flowing through the public lands of the West which have been reserved by the Federal Government. The chief hydrographer of the United States Geological Survey estimates the developed water power in the United States to-day in round numbers at 6,000,000 horse-power, but he believes the undeveloped water power which might be realized from the normal flow is 66,000,000 horse-power. Further he estimates the possible ultimate development through the building of flood storage reservoirs at the tremendous total of 200,000,000 horse-power. It is thus seen that even with the enormous developments which have been going on in recent years we are but at the threshold of our water power development, having so far utilized less than one thirtieth of this resource.



Gaging car and United States Geological Survey engineer on the Yakima River, Washington

TABLE SHOWING IN SECOND FEET THE FLUCTUATIONS IN FLOW OF EIGHT REPRESENTATIVE WATER POWER RIVERS IN 1908—A TYPICAL NORMAL YEAR.

	Maximum	Minimum	Mean
Susquehanna	276,000	5,000	47,500
Potomac	100,600	2,000	12,480
Housatonic	25,700	550	3,000
Savannah	130,000	3,400	13,000
Chattahoochee	15,400	415	1,600
Grand (in Colorado)	17,000	400	2,700
Sacramento	141,000	4,800	13,000
Columbia	198,000	72,200	28,000

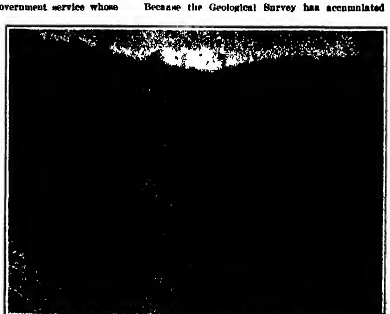
To obtain a mind picture of what this power means it may be reduced to terms of operating locomotive engines. There are in the United States about 51,000 locomotive engines, and the average engine has approximately 1,000 horse-power. The annual consumption of all the railroads is about 90,000,000 tons of coal. The maximum power from all the streams of the United States would, therefore, operate four times the number of all the locomotives of the country if they were running day and night every day in the year, or would do the work about twelve times greater than that actually performed by all American locomotives or represent a consumption of over a billion tons of coal a year—double our coal consumption of last year. While these are enormous figures compared with the actual power development to date, there is nevertheless intense interest throughout the entire United States at the present time in the value and the possibility of the country's waters and their utilization for power, for irrigation, for navigation, and for municipal purposes. What study is being made of the great resource in connection with any of these vital problems? What information if any is available to the owner of a water power to enable him to determine the equity of the price offered?

There is a branch of the Government service whose work is devoted to all these matters—study of the volume of streams, in low water and in flood, current velocity, gradient, storage, power, irrigation and drainage possibilities—in fact, it makes river surveys; it is the Water Resources Branch of the United States Geological Survey. Since such work was systematically undertaken by the Survey in 1895 Congress has appropriated $2,082,500 to carry it forward, and the result is that we have now a pretty fair working knowledge of most of our principal rivers and many tributaries. In some years over 1,000 stream gaging stations have been maintained in most sections of the United States. This season the Survey has approximately four hundred such stations in operation, and is doing co-operative stream measuring with States and individuals at as many more.

In the contemplated development of a stream for power, irrigation, or any other industrial purpose the first question that arises is "What is the flow, the volume, of this stream?" How much water will it deliver in a day, in a month, in a year, in a period of years? To what extent can it be depended upon as a never failing servant of man? To answer these questions the Government hydrographic engineers are making their thousands of measurements annually and computing the results for the information of the public. At each Survey gaging station the height of the river is recorded daily. Then at frequent intervals with the river at different heights, the hydrographer visits the station and makes soundings across the stream bed every few feet so as to get a cross-section of the river bottom. With this cross-section of the body of water and the speed of the flow, usually obtained with an electric current meter lowered into the water, he can readily compute the number of cubic feet of water passing a given point per second. This flow, of course, varies greatly at different seasons. Variation is of the greatest importance in considering the river's flow for both irrigation and power. The low water flow largely fixes the river's value in both cases. If for irrigation it must be known how much water can be depended on during the irrigation season, and if the water is to be stored in a reservoir the total annual flow must be determined. If for power the low water flow largely fixes the value. If a factory is to be run by the power twelve months in the year then the two or three months of lowest water will measure the capacity of the plant. The fact that an ordinary flow may be a hundred times greater, as is the case in many rivers, will be of no importance, unless storage reservoirs are provided.

Because the Geological Survey has accumulated a

Long trolley line and car for measuring the volume of the Susquehanna River.



In rivers that are not too deep the gaging is done by wading in high rubber boots.

great amount of river data, the Government was able during the first year of the adoption of the present water power regulations for the public lands to make withdrawals along ninety-seven western rivers, including thousands of water power sites and involving millions of horse-power. To have acquired the information for these withdrawals specially for the purpose would have necessitated an enormous amount of field work, in fact, it could not have been accomplished in a single year with even an unlimited force and expenditure.

This stream measurement work of the Survey carried on throughout the West for many years prior to the passage of the irrigation law enabled the Reclamation Service to begin its construction work at once and to push it with a rapidity that was the astonishment and envy of visiting British irrigation engineers who had worked in India and Egypt. It is admitted that the integrity of these great irrigation works in the West, upon which over $70,000,000 is being expended by the Government, rests upon the hydrographic work of the Geological Survey. The formula for arriving at the horse-power in any river is a simple one. Multiply the volume of the stream flow in second feet, i. e., the number of cubic feet of water passing a given point every second, by the fall of the river in feet and divide by 11. This will give the actual horse-power, which is 80 per cent of the theoretical horse-power. One second foot equals approximately 7.5 gallons; thus if a small stream has a flow of 100 second feet, or 750 gallons per second, and a fall of 50 feet it will develop 454 horse-power.

Instruments in house give continuous automatic record of the rise and fall of a river which, in connection with the measurements made from the gaging car, furnishes data for computing the daily flow of the stream for every day in the year, or for any hour of the day or night.

But how is it possible, without a current meter or the services of an engineer, to make a rough estimate of the flow of a stream? First, make soundings across the stream, say, every 10 feet, and from this compute the number of square feet in the cross-section. Then to find the speed of the current, stake off a straight reach of 100 feet and drop a piece of cork in the stream near the right bank. Note the time it takes to float the 100 feet between stakes. Repeat the operation from the opposite bank and again for the middle of the stream. From these three find the average flow of the river per second. Multiply this by the square feet in the cross section and the result will be an approximation of the volume of the stream in second feet.

Thus, for example, a creek 50 feet wide has an average depth of 6 feet, the soundings showing 6, 8, 9 and 7 feet of water at the four 10-foot intervals, and of course 0 at either shore line. Adding these 30 and dividing by 5 we get 6 feet of average depth which, multiplied by the 50 feet of stream width gives 300 square feet for the cross section. Now the two corks dropped in near the banks each consume 100 seconds in floating the 100 feet, while the center chip floats the distance in 50 seconds. The flow of the shore water is thus 1 foot per second—an average for the stream of 1 33 1/3 feet per second. This multiplied by the 300 foot cross-section gives a stream flow of 400 second feet. If this creek should be found to have a fall of 40 feet in a certain distance, say, a mile, it would be capable of developing 1 455 theoretical horse-power at 80 per cent efficiency.

Beautiful waterfalls by no means afford all the power possibilities of rivers. As much power can be extracted

(Concluded on page 277.)

Where possible, railroad bridges are utilized for measuring streams at five- or ten-foot intervals.

Rock Creek, Washington, showing stream bed survey and method of gaging velocity every five feet, by electric current meter

Plastic Art of Prehistoric Man

Clay Figures Modeled by an Artist of Twenty Thousand Years Ago

GRADUALLY our knowledge of our remote ancestor prehistoric man is increasing. And with our expanding information, we see ourselves forced now and again to materially change our point of view. There is a general tendency to credit some of the early inhabitants of our globe with much more advanced faculties than had formerly been supposed. And recent finds seem to indicate that in physical development, too, one type at least of very ancient man comes much nearer to his modern descendant than was hitherto believed.

Public attention has recently been drawn to a discovery in the caverns at Tuc d'Audubert, Department of Ariège, France, which throws into the limelight the remarkable work of the prehistoric artist. The carvings, often very clever, of prehistoric man have long been known and only recently we had occasion to describe the wonderful mural paintings of Altamira in the Spanish Pyrenees. But more remarkable perhaps than any of these are the clay modeled figures of bisons discovered by Count Begouen in the cave of Tuc d'Audubert.

Some time ago the Count had found in this cavern prehistoric mural paintings of animals. In his further explorations, last October he broke a way through a mass of stalactites, and at the end of a gallery over two thousand feet back from the entrance he came upon clay figures representing a male and a female bison in wonderful state of preservation as our illustrations show. The two figurines lean against a boulder of rock which has fallen from the vault to the floor of the cavern. The foremost figure, a female, is thirty-two inches long and measures eleven inches across the deepest part of the body. The corresponding dimensions in the male figure are each about one inch greater. The side of the body lying against the boulder has been left in the rough unmodeled. While the cavern is fairly dry and the clay is traversed by numerous cracks, by great good fortune the figures have been left otherwise almost intact. The only damage is that one horn and the tail of the female are broken off—the latter having been found in the floor of the cave. The surface of the figure has evidently been smoothed by the artist's hand whose marks can still be distinguished. The eye of the female is made out of a clay ball with the pupil marked by a pit giving it a very lifelike appearance. The male has merely a round and somewhat lifeless eye. The beard is drawn in bold lines evidently with a sharp stick or bone, while for the wooly mane the artist used his thumb, whose imprint can still be clearly distinguished.

Around the statuettes were found imprints of human feet and of bears' paws. The discoverer hesitates to move the figures from their original site, for fear of damage to them.

Where Count Begouen, breaking through a mass of stalactites, found the figurines.

Prepared by the prehistoric modeler, or modelers, but not used: Worked clay found on the floor of the cave.

These figures are said to be the first prehistoric clay figures discovered. The illustration on the left shows one of the bisons in side view. On the right is seen the splendidly modeled head, in front view.

Photographs by courtesy of the *Illustrated London News*

Possibly made twenty thousand years ago. The clay figures of two bisons found in the cave called Tuc d'Audubert, France.

Logwood of Commerce

THE imports of logwood into the United States during 1919 amounted to 32,368 tons valued at $[illegible]8,418. The largest quantity, more than one half or 16,622 tons came from Hayti, 11,187 from the British West Indies, and 1,005 tons from British Honduras. The remainder is derived from Mexico, Santo Domingo and from the northern part of South America. Logwood was first shipped to England during the reign of Queen Elizabeth, but the unskilled dyers of her time found that it yielded a fugitive color, and so in the twenty-third year of her reign logwood was prohibited from being used under severe penalties. After a hundred years of prohibition from the English markets it was again allowed to be imported and used. It came into use in the United States during the middle of the eighteenth century, and at one time formed a much more extensive trade than it does at the present time.

The tree which produces logwood (Campeachy wood or *palo de campeche*) is botanically known as *Hæmatoxylon campechianum*. It often reaches fifty feet in height and sometimes from twelve to twenty-four inches in diameter. The wood is very hard, of a fine compact grain, a specific gravity greater than water, and is almost indestructible in contact with the soil and air. The pinnate leaves are handsome and of a fine dark glossy green color resembling those of the white thorn; the flowers are pea shaped in fine yellow racemes.

The trunk is cut into large logs, the bark and the white sapwood is chopped off because the dark red heartwood is the only valuable portion. After it has been chipped a little while it turns black, and if it lies in the water it dyes it like ink. Its value is in proportion to the size of the logs, the largest being the choicest kind. It is imported chiefly in short lengths, after which it is chipped or ground, and packed in casks and bags ready for the dyers, hatters' and calico printers' use, who esteem it very much because it affords the most durable deep red and black dyes.

Logwood contains a peculiar coloring principle called hæmatoxylin ($C_{16}H_{14}O_6$), which forms an orange red solution with boiling water, becoming yellow as it cools, but recovering its former hue when heated. Alkali converts it first to purple, then to violet, and lastly to brown, in which case it seems to be decomposed. Metallic oxide unites with it, forming blue compounds. Gelatine throws down reddish flocculi. Stannous chloride renders it lilac.

Logwood shavings yield their color to water and alcohol, the latter extracts it more readily than water. The color of its dyes is red, inclining to violet or purple. Its aqueous decoction, left to itself, becomes yellowish, and at length black. Acids turn it yellow, alkalies deepen its color and give it a purple hue. The proper shades and colors are obtained by the use of aluminous mordants. A blue color may be obtained from it by the addition of verdigris, but the great consumption of logwood is for blacks, which are obtained by alum and iron bases, and of any requisite degree of intensity. Alcohol extracts most of the active principles of this wood and forms a deep colored tincture.

The cutting, barking, and transport of logwood constitutes an industry in nearly all parts of tropical America. The tree is indigenous to the forests of Tabasco in Mexico, to the lowlands, islands, and banks of rivers and lagoons, and gives employment to thousands. It forms one of the principal articles of export from that State. The Honduras logwood trade has been spasmodic of late years, although the dye it yields is superior to that obtained from the wood cut in Jamaica and St. Domingo. The Honduras and Yucatan wood sells for about $200 per ton, and the St. Domingo wood only for about $100 per ton. This is a very different price from that which was paid in the earlier days, when it was sometimes sold for $500 per ton. The Jamaica and St. Domingo wood is used in the dyeing of carpets and other coarse cloths, while the Central American is employed for dyeing all kinds of woolen, cotton, and silk fabrics.

Teaching Children Safety Principles

THE Brooklyn Rapid Transit Company has entered into an arrangement with the American Museum of Safety for a six months campaign in the public schools of Brooklyn on the subject of safety in the streets of the borough. The American Museum of Safety has been working along similar lines in the borough of Manhattan for some time, and has in this matter the hearty co-operation of the Board of Education.

The Brooklyn campaign has been in process of planning for several weeks. As rapidly as the time of the two lecturers who are employed will allow, the system of instruction will be extended from school to school, until the entire borough is covered. It is estimated that in the four months which remain before the closing of the schools for the summer vacation most of the territory can be gone over. But the work will not stop with the summer vacation. It is planned to continue it in the vacation schools during the summer months.

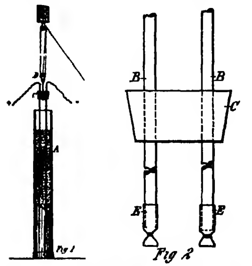
The basis of the campaign is furnished by the daily talks to the school children, followed up by the distribution of pamphlets, which the children are encouraged to take home and discuss with their parents. The talks themselves are illustrated by models which enable the lecturers to point out in a graphic way the correct and incorrect methods of boarding and alighting from street cars, and the handling of live wires and similar dangerous objects which may, through accident, be encountered in the public streets.

Cleaning Grimy Hands.—Automobilists who act as their own chauffeurs and mechanicians will be glad to learn of a practical process for quickly cleansing the hands of assorted and tenacious varieties of grime accumulated when adjustments or repairs are necessary. This process, as recommended in [illegible], consists in a preliminary rubbing (twice repeated) with gasoline, followed by saturation, and rubbing with sweet oil or butter. The hands are finally washed thoroughly with soap and water, the nails being cleaned specially with a mixture of benzine and alcohol.

A New Type of Water Rheostat

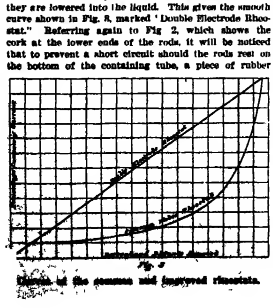
By J. N Clarke

THE ordinary form of water rheostat, having one electrode at the bottom of a wooden barrel, or similar non-conducting container, and the other electrode suspended in such a manner that it can be made to approach the bottom electrode, thus diminishing the distance between them and the resistance of the conducting electrolyte, has many disadvantages. In the first place, it is usually necessary to salt the electrolyte (water) to make it conducting enough for most purposes, and this gives rise to unpleasant products of electrolysis, making the rheostat odorous and dirty and often an unmitigated nuisance. Further, the resistance of this salted electrolyte is constantly changing as the electrodes are dissolved in the hydrochloric acid resulting from the passage of the current, so that a constant watch has to be kept of the adjustment of the upper electrode in case a constant current is wanted. And finally, but not least of all, such a rheostat does not give a constant gradation of current with the degree of immersion of the upper electrode, but gives a curve as that shown for "Common Water Rheostat" in Fig. 3. There is a considerable initial increment of current—the minimum resistance of the electrolyte—and after that, there is no considerable additional increment of current until the upper electrode is almost in contact with the lower, when the current value rises rapidly, making fine adjustments with the apparatus very difficult



Water rheostat giving a smooth gradation of resistance.

To obviate these difficulties and also to secure an even increment of current for equal increments of immersion of the electrode over a long range, the following apparatus has been devised by the writer It consists in its essence of a container A which need not be insulating, the preferred form being a long 6-inch iron pipe, capped at the lower end of two electrodes *B*, placed side by side and lowered together into the pipe *A by means of some suitable gear, as for instance* the pulleys *D* and the cord, which may be run to a winch for hand raising and lowering of the electrodes. The two electrodes *B B* are of ¼ inch iron rod thrust through 2-inch rubber corks, as shown enlarged at Fig 2, and each of these rods is connected to an opposite side of the line It will thus be seen that the electrolyte between the rods is that which resists the passage of current, and further, that the amount of current passing is exactly proportional to the surface of the rods in the liquid, which varies with the amount they are lowered into the liquid. This gives the smooth curve shown in Fig. 3, marked "Double Electrode Rheostat." Referring again to Fig 2, which shows the cork at the lower ends of the rods, it will be noticed that to prevent a short circuit should the rods rest on the bottom of the containing tube, a piece of rubber tubing has been slipped over each one and tied with a piece of string.



Curves of the common and improved rheostats.

The advantages of this form of rheostat are numerous. In addition to its giving a smooth gradation of resistance without steps, it can be held constant at any point, as on account of the large surface of the electrodes exposed to the liquid sufficient current can be forced through ordinary tap water without salting or acidifying it with the result that the resistance of the electrolyte does not sensibly vary, and there are no unpleasant compounds formed, which ordinarily are so unclean in such a rheostat Should it be found however, that the water was not sufficiently conducting for the purpose in hand caustic potash may be added drop by drop until the conductivity is obtained Caustic potash is preferable to salt in that it will not attack and form unpleasant compounds with the iron

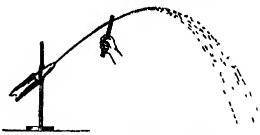
This form of rheostat will be found very useful in many kinds of experimental work, and it is hoped that it will be of service to many experimenters who like the writer, have long sought a reliable rheostat giving a smooth gradation of resistance over a long range

The Effect of Static Electricity on Water

A NOVEL static experiment is illustrated in the accompanying sketch The writer saw it at a popular science lecture but it can easily be duplicated by the home experimenter

A thin jet of water is arranged so that it shoots about ten feet up. The stream will be made up of fine drops at the farthest end If now a hard rubber rod (the kind found in static experiment sets) is rubbed and brought near to the stream, the drops will immediately come together to form larger ones. The rubber rod should be held near the stream, and a few feet from the nozzle. The experiment illustrates how static electricity may account for large rain drops.

The apparatus comprises a rubber tube connecting to a water supply having some pressure a jet which



Controlling size of water drops electrically

may be made from glass tubing and which should have a small opening so that the stream of water will be fine, and a rod which may be charged

As variations, the use of a glass rod or a stream of oil is suggested On a smaller scale the effect of the charged rod on a thin stream of water from an ordinary faucet may also be tried.

Goniometer for Microscopes

By C C. Kiplinger, Instructor of Science, Lincoln (Ill.) High School

THE manufacturers of microscopes rarely fit their low priced instruments with rotating stages Hence the possessor of one of these otherwise efficient instruments is ordinarily unable to measure crystal and extinction angles.

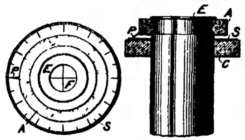
The goniometer here described is simple in construction and efficient in action A ring, or flange of cork one quarter inch square in cross-section should be cut of such internal diameter as to fit the eye-piece tightly This ring should be blackened with a mixture of lampblack and shellac varnish When dry, it is slipped over the eye-piece and brought to the position shown at *A* in the drawing

Another cork ring *C* cut so as to have a cross section one quarter by one half inch, and tightly fitting the draw tube, is placed on it at *C* This flange forms the support for a scale graduated in degrees. The scale is best made as follows A large circle at least a foot in diameter, is drawn on white card board and the degrees marked as accurately as possible This scale is then reduced by photography to the required size, and a print is made on a "gas light postcard. The print should be cut so as to fit the draw tube, and fastened to its cork support with a little shellac varnish, as indicated at *S* A short piece of a pin or needle is pressed into the cork ring *A* at *P* to serve as a pointer

The eye-piece must be fitted with cross hairs. A bit of silk thread is frayed out and several individual fibers obtained. The lenses having been removed, a bit of mucilage is put on the diaphragm at two diametrically opposite points. One of the fibers is stretched across the field at these points, using a splinter of wood to assist in the operation. Another fiber is fixed at right angles to the first, and their intersection made to coincide with the center of the field. The eye-piece is now assembled and the instrument is ready for use

This piece of apparatus used in connection with the polariscope attachment described in the SCIENTIFIC AMERICAN of June 25th, 1910, page 524 will give the student of mineralogy or chemistry much satisfaction in the pursuance of petrographical research It will be noted that this form of goniometer in operation does not disturb the optical center of the objective as regards the axis of the microscope

The relative dimensions of small objects which are at the same distance from the center of the field may be estimated by turning the goniometer so that a certain cross-hair coincides, first with one edge and then the opposite, and noting the angular magnitude The dimension to be measured should be perpendicular to the hair which passes through its terminus This being the case, the tangent of the angle involved is the measure of the dimension Since for angles less than fifteen degrees, the tangents vary approximately as the angles



Goniometer for microscopes.

themselves the angles which these small objects subtend are measures of their relative diameters Thus used the goniometer becomes a tangent micrometer

A Direct Current Motor from a Telephone Ringer

By Guy Hubbard

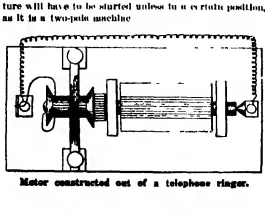
A VERY good experimental electric motor which is reversible and has a speed reducing gear may be easily made from an old magneto telephone ringer The ringer is an alternating current dynamo having brushes, which rub on the ends of the armature shaft This shaft is in two sections and is insulated from the armature by a core The ends of the armature coil are soldered to these sections.

In order to change the machine into a direct current motor a commutator must be put on The conditions are different from those in a common motor The commutator is made from a small spool The sections are of thin brass and should be each a little less than half the circumference of the spool Short lengths of wire should be soldered to the ends of these and after fitting them to the sides of the spool they are fastened with a rubber band snapped around them

The brush on the gear end of the magneto is loosened and turned around A small hole is punched in it and adjusted so that it is on a line with the center of the armature shaft There is a tapered hole in this end of the shaft The commutator is fastened on by a wood-screw which fits the spool and is somewhat longer The threads are filed from the end of it so that it fits this hole tightly The commutator is adjusted with its open spaces exactly opposite the centers of the channels of the armature The wire from one of the sections is bent over the end of the spool and is twisted around the head of the screw The commutator is then tightened by a few raps of a hammer

The brushes are narrow strips of thin brass fastened to small wooden blocks Each of them should be fitted with a binding screw These are fastened on each side of the commutator and adjusted to rub on the commutator or at points exactly opposite

The wire from the other section is bent around the end of the spool and placed in the hole in the contact strip, so as to run smoothly when the armature is turned The contact strip which rubs on the shaft and the one with the hole in it are connected by a wire The machine will now run at good speed when a strong battery is connected to the brushes The armature will have to be started unless in a certain position, as it is a two-pole machine



Motor constructed out of a telephone ringer.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

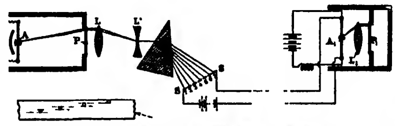
The Marino System of Color Telephotography

IN a recent number of *Lumière Electrique*, M. Marino explains his system of telephotography in black and white and in colors. Selenium is of course used, as in most telephotographic systems. It will be recalled that in the Korn process, the transmitting element is a selenium cell, selenium being a metal the electrical resistance of which is a function of the luminous intensity to which it is subjected at any given moment. Marino employs not one cell, but a battery of seven cells, each responsive to a single color - red, orange, yellow, green, etc. In transmitting pictures in black and white each cell responds to the particular radiation to which it is sensitive. In transmitting pictures in colors they transmit the fundamental tints of the original, decompose them at the transmitting station, and recompose them at the receiving station.

At the transmitting station the photographic plate *P* the colored picture on which is to be transmitted in black and white, is illuminated by an electric arc *A*. Each ray of light after passing through the plate falls upon a convex lens *L* by which it is refracted to the concave lens *L'*, by which in turn it is thrown on a prism. The prism analyzes the ray into its fundamental spectrum colors and the various colored rays in turn fall upon the corresponding selenium cells *S' S"* ... *S'*. The cells are so mounted that rays of a particular color will always fall upon the proper cell. The cells are included in the line circuit leading to the receiving station. Their total conductivity is equal to that of a single cell receiving composite light. The effect produced at the receiving station, because of the variable conductivity of the entire battery of transmitting cells is proportional to the amount of light received from any point of the original image at a given moment.

The original photograph is decomposed point by point by regularly displacing across the photographic plate an opaque ribbon perforated with very fine holes, arranged in step-like series so that the upper edge of the second lies at the level of the lower edge of the first, etc., as shown. Each perforation as it passes across the plate permits the passage of a horizontal band of light from the arc behind the plate. The horizontal distance between two consecutive holes or perforations is such that one perforation at a time passes across the plate, and that an appreciable interval is allowed between the exploration of the plate by the two ribbons. During this interval the selenium cells are at rest and are thus enabled to lose their residual conductivity, which they tend to preserve as the result of a well known effect of inertia or hysteresis. Because the intensity of the light is distributed among all the selenium cells, each receiving but a part of the light resolved by the prism the hysteresis is considerably diminished.

At the receiving station a short length electric arc *A* is to be found, to which a very weak direct current is supplied. The arc is connected with the line circuit and hence with the selenium cells. The variations in resistance of this circuit have a very marked effect on the luminous intensity of the arc although that effect is not noticeable to the eye. These variations in light fall on a photographic plate *P*, in front of which an opaque ribbon pierced with holes or openings identical with those of the transmitting ribbon is displaced synchronously with that of the transmitting station. The sensitive plate is affected in such a manner as to reproduce the original together with all the gradations in color and tone.

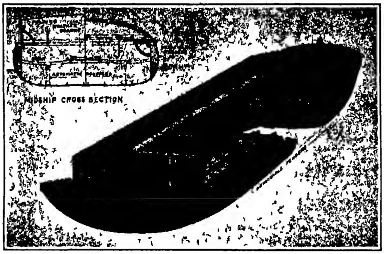


The Marino system of telegraphing pictures in colors.

It is of course practicable to transmit not only a colored photographic transparency, but also the image of any fixed object reflected by a mirror. The perforated ribbon passes over the reflection exactly as in the case of the photographic plate.

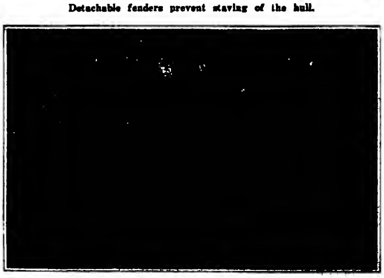
In transmitting photographs in colors the seven cells of selenium instead of being mounted in parallel on a common circuit, are divided into three groups, each of which form part of a circuit of a Poulsen arc, generating waves of varying length. At the receiving station three wave detectors included in three resonating circuits (each of which has a frequency corresponding with that of one of the set of waves emitted by one of the Poulsen arcs) influence three receiving arcs, in front of which colored filters are mounted corresponding with the three groups of selenium cells. The three sets of colored rays emanating from the three arcs are concentrated by lenses on a sensitive autochrome plate, explored in the manner already explained, by an opaque perforated ribbon, so that each point is allowed to exert its influence, while at the same time the corresponding point of the original is illuminated by an opening in the perforated ribbon of the transmitter.

By superposing the impressions made by three sets of colored rays, the shades and intensities of the original are exactly reproduced in their proportionate intensities. When the original has been completely explored by the perforated ribbon the receiving plate has completely responded. Developing is the next step.



How the Lundin lifeboat is constructed.

Detachable fenders prevent staving of the hull.



Lundin boat undergoing a Government test.

The Lundin Decked Lifeboat

IT is now almost a year since the urgent necessity for revising regulations referring to life-saving appliances at sea was brought home with terrible force to the public mind through the sinking of the "Titanic." Since that cruelly unnecessary loss of life, inventors and boat builders have been active in devising boat construction which would meet all the new requirements made by the Board of Supervising Inspectors and make it possible to carry three times as many boats as formerly constituted the equipment of an ocean liner, without encroaching unduly on the deck promenade space.

Before the general adoption of wireless stations on ships, those who were forced to betake themselves to the boats in case of disaster, might expect to sail about for days before reaching land or being picked up but now, with many more ships passing back and forth in the prescribed lanes of convenient navigation help can reasonably be expected to arrive within a few hours, and it is, therefore, merely a question of having means to keep every body afloat under fairly comfortable and safe conditions until the rescuing vessel appears on the scene. If this means of keeping afloat can also be propelled and maneuvered as readily as the standard type of life-boat it is of course an added advantage, and if it is practically impossible to overturn it or dent and damage it by smashing against the side of the ship, we may say. The ideal life-boat is found.

The Lundin decked life-boat seems to answer to this description perfectly, as was demonstrated recently in exhaustive tests made at Newport News and San Francisco by the United States Army Transport Service, and only a few weeks ago by the Board of Steamship Inspectors, when they visited New York for the purpose of looking into the merits of various marine life-saving appliances.

The boat consists of a decked hull with the sides extending above the deck some 15 inches. Folding weather boards of a substantial construction are hinged to the top edge of the sides and may be raised in a second, automatically locking themselves in the upright position. Similar boards are then raised at the ends, and the boat is ready for lowering.

The boat is divided into eight watertight compartments by transverse bulkheads, which carry the deck above the load waterline, thereby making the boat self-bailing by means of scuppers through the bottom in each compartment. A manhole is also provided in each compartment to allow for inspection and painting.

On each side a large fender is carried, made of a very buoyant material (Balsa wood), which is so treated that the buoyancy is permanent.

These boats carry the regular ocean-going equipment, including mast, sail, and rigging, and can be rowed or sailed as readily as the ordinary type of life-boat, furthermore, they are well adapted to being towed, which is a consideration of some importance, since it is the intention to carry some motor-equipped life-boats on large passenger carriers.

This life-boat is rated with a co-efficiency of 0.9 as compared with a rated co-efficiency of 0 6 for ordinary life-boats, and has 25 per cent more carrying capacity for a given length

Two of these boats may be stowed on each other, or nested, without risk of damage under one pair of davits, and it is easy to compute what a saving in deck space this represents.

The Decision in the Wright Aeroplane Patent Case

On February 27th, 1913, Judge Hazel, in the District Court of the United States for the Western District of New York, handed down a decision upholding the Wright patent in the case of the Wright Company v Herring-Curtiss Company and Glenn H Curtiss. All the elements in the Wright machine were conceded to be old. The question at issue was Were the Wrights the first to discover that the vertical rudder of a flying machine must be used in conjunction with wing warping devices or ailerons in order to prevent the machine from spinning on a vertical axis? The Court held that they were, and that Curtiss had infringed the patent in which that discovery is described and claimed The decision is too long for republication in its entirety, but the following abstracts will give the average reader all that he need know

There are eighteen claims in the Wright patent, but only claims 3, 7, 14 and 15 were held to be infringed. They read as follows

"3. In a flying machine, a normally flat aeroplane having lateral marginal portions capable of movement to different positions above or below the normal plane of the body of the aeroplane such movement being about an axis transverse to the line of flight where by said lateral marginal portions may be moved to different angles relatively to the normal plane of the body of the aeroplane and also to different angles relatively to each other so as to present to the atmosphere different angles of incidence, and means for simultaneously imparting such movement to said lateral marginal portions, substantially as described

"7 In the flying machine, the combination with an aeroplane, and means for simultaneously moving the lateral portions thereof into different angular relations to the normal plane of the body of the aeroplane and to each other so as to present to the atmosphere different angles of incidence of a vertical rudder, and means whereby said rudder is caused to present to the wind that side thereof nearest the side of the aeroplane having the smaller angle of incidence and offering the least resistance to the atmosphere, substantially as described."

"14 A flying machine comprising superposed connected aeroplanes, means for moving the opposite lateral portions of said aeroplanes to different angles to the normal planes thereof, a vertical rudder means for moving said vertical rudder toward that side of the machine presenting the smaller angle of incidence and the least resistance to the atmosphere, and a horizontal rudder provided with means for presenting its upper or under surface to the resistance of the atmosphere, substantially as described."

"15. A flying machine comprising superposed connected aeroplanes, means for moving the opposite lateral portions of said aeroplanes to different angles to the normal planes thereof a vertical rudder, means for moving said vertical rudder toward that side of the machine presenting the smaller angle of incidence and the least resistance to the atmosphere, and a horizontal rudder provided with means for presenting its upper or under surface to the resistance of the atmosphere, said vertical rudder being located at the rear of the machine and said horizontal rudder at the front of the machine, substantially as described."

It was contended for the defendant that the Wrights merely improved the known gliding machine, and that the wing tips, horizontal rudder, and vertical rudder were old separately and in combination. But the Court could find no similarity between the constructions of Lilienthal, Pilcher and Chanute on the one hand and the Wrights on the other

The Court analyzed the prior patents cited as anticipations against the Wrights, but failed to find that they revealed the Wright principle.

The Henson British patent of 1842, the Maxim patent of 1889, the Lanchester British patent, the patents to Crepar and Johnston the Harte British patent of 1870, the famous Mouillard patent (No. 582,757), and the Boulton British patent of 1868 were all rejected as complete anticipations of the Wright invention. None of these patentees had in mind the principle that the steering or control of the machine depended upon the tilt of the wings in connection with the use of the vertical rudder

Importance was attached to the revived Mattullath application for a patent, dated January 8th, 1900, but the Court thought there was "an utter failure to show that the catamaran like structure of 180 feet over all and revolving disk 40 feet in diameter, with its decks, compartments, and machinery, was complete, or that it was even remotely possible to reduce it to practice and without such showing it is devoid of material significance Even assuming that it belongs to a prior art the structure is not provided with movable side ailerons simultaneously adjustable, or a movable rudder, but has a fixed rudder which has no connection with the ailerons."

One additional publication, the Ader article, published in France in 1893, was dwelt upon Ader's apparatus somewhat resembles the wings of birds or bats, having tips which could be moved forward and backward. As our readers know, the machine was of the monoplane type and carried a motor

"but," said the Court, "as there was no connection between the warping features and the rudder by which the lateral balance of the machine was secured, the publication is not entitled to be considered in limitation of the claim in suit embody ing such elements."

Continuing, the Court states "A summary of what had gone before in aerial machinery unmistakably discloses first, publications which did not contain descriptions of apparatus of such clearness and definiteness as to enable the skilled in the art to construct therefrom an operative device, or clearly suggesting ways or means to solve the problem of lateral balance I am of opinion, after complete consideration of the testimony on both sides, that the patentees by their method of securing the equilibrium of the planes made an important advance in an embryonic art They were not the first to conceive the idea of using monoplane or biplane surfaces for flying, nor the first to support two planes at their margins one above the other, or to use vertical tails or rudders for steering, or to plane horizontal rudders forward of the machine to guide it upward or downward in its flight. The prior separate use of such elements is freely admitted by the patentees, but they assert, rightly, I think, that the patented combination was a new combination performing a new and novel result. The antecedent patents, the efforts to perfect the gliding machine and to provide means for restoring equilibrium, in short, the many unsuccessful attempts to remedy existing imperfections in aerial machinery, all bear witness to the fact that the achievement of the patentees required the exercise of the inventive faculty Having attained success where others failed, they may rightly be considered pioneer inventors in the aeroplane art. Their concept was practical, and their combination of old and new elements meritoriously advanced the operativeness of aeroplanes of this type from which astonishing flights have resulted."

There was much discussion at the bar as to claim 3, which does not include the vertical rudder as an element. The important feature of the claim is that the lateral marginal portions of the planes must be capable of movement to different angles relatively to the normal plane of the aeroplane and about an axis transverse to the line of flight, the purpose of said movements being to present to the atmosphere different angles of incidence. It was argued that without the co-operation of the vertical rudder the claim was wholly impracticable. The Wrights contended that there is shown a sub-combination which is valid and which should be sustained There is evidence that the marginal ends of the supporting planes are capable of moving simultaneously in different angular relations to the plane and to each other without the assistance of the vertical rudder, but the result was not satisfactory, as the machine in its flights skidded to the side, an imperfection which has been remedied by the use of the vertical rudder in conjunction with the ailerons. So the Court held that "it is not essential to the validity of claim 3 that all parts of the machine or all parts specified in other claims, which are necessary to its operativeness should be included therein and resort must be had to the specification for a disclosure of the parts necessary to insure the practicability of a patented device In the Wright structure a new and novel result was attained simply by having the ailerons on the ends of the planes without the supplemental feature of the vertical rudder The warping feature is, in fact, the essential part of the machine while the vertical rudder insuring successful flying is a valuable adjunct without which lateral balance could not be restored The employment, in a changed form, of the warping feature or its equivalent by another, though better effects or results are obtained, does not avoid infringement.

Is there in a Curtiss machine a tendency to spin or swerve which is checked or counteracted by the operation of its vertical rudder?

The Court answered thus "If I am correct in my interpretation of claim 3, and the rule of law applicable thereto, the ailerons of defendants construction and the manner of using them are within its scope The witness, Curtiss, frankly testified that the purpose thereof is to preserve the lateral balance without the use of any other element or part It making no difference whether the aeroplane is in a straight or curved flight Such concession supports the infringement of the claim under consideration."

"The defendants are believed to have appropriated the substance of claim 7, and to have infringed claim 14, inasmuch as in addition to the essential elements of the Wright patent and the object with which such elements are used, they also employ in their aeroplane a horizontal rudder for 'presenting its upper and under surfaces to the resistance of the atmosphere.' Claim 15 contains the essential elements and specifies that location of a vertical rudder at the rear of the machine and a horizontal rudder at the front thereof

"The defendants have embodied in their aeroplane the various elements of the claims in suit While it is true, as pointed out herein, that the defendants have constructed their machine somewhat differently from complainant's and do not at all times and on all occasions operate the same on the Wright principle, yet the changes they have made in their construction relates to the form only They have constructed their machine so that it is capable of restoring equilibrium in substantially the same way as is complainant's machine, and the evidence is that on occasions, depending upon aerial conditions or other disturbing causes, they use the vertical rudder not only to steer their machine, but to assist the ailerons in restoring balance."

The decision marks the first important victory for the Wrights in this country in their effort to uphold their patent. Both German and French courts have handed down similar decisions.

Notes for Inventors

A Combined Snow Plow and Shovel — In patent No 1,049,812 Frank Darling of Plano, Ill presents a combined snow plow and shovel, which has blades so connected with each other and with a handle that they may be shifted to form either a plow or a shovel as may be desired

Collapsible Drinking Cup — Henry W Bowman of Barboursville Ky has patented, No 1,049,199, a collapsible drinking cup in which a strip of material is bent to form a spiral coil serving as the wall of the cup and has a handle which co-operates in holding the cup collapsed when not in use

A Macbeth Lantern Globe — Patent No 1,048 981, to George A Macbeth of Pittsburgh, Pa., has for its subject a lantern globe of glass upon the edge of which a protective metal sheath is formed by electroplating metal upon the edge of sufficient thickness to protect the edge from chipping

Another Spring Wheel for Automobiles. —Harper E Stratton of Empire, O, in a patent, No 1,049,418, presents a vehicle wheel in which spring bow-shaped spokes extend in pairs between the hub and the tire or rim and wedge blocks are interposed between the inner ends of the spokes and seated in recesses in the hub

A Number of Gas-burner Patents — Edwin H VanZandt of St Louis assignor to VanZandt Gas Appliance Company of the same place has secured patents Nos 1 045 404 and 1 045 485 for gas burners a patent No 1 045 486 for a gas grate and patents Nos 1 045 467 to 1,045 475 inclusive for gas burners varying in structure

Help for Swimmers —A swimming glove is shown in patent No 1 049,448, to Hoy P Chase of Stockton Cal and includes in connection with an ordinary glove having a hand and finger portions, a suitable web which is secured to the tips of the glove fingers and extends over the back of the glove and is stitched at a point near the wrist in such manner as to form a pocket between the web and the back of the glove

Match Splints from Pulp — Co-operative Syndicate of New York city as assignee of Warren B Hutchinson of Newark N J, has secured a patent for a match machine by which match splints are formed from pulp, the pulp being separated into separate strips or splints and a series of grooved heated rollers being utilized to shape the splints, the splint forming members after leaving the rollers being cut off into suitable individual splint lengths

A Motor-controlling Mechanism — Charles R Pratt of Montclair N J in patent No 1 048 980 provides a motor-controlled mechanism in which there are a number of motors with means which maintain a predetermined relative speed of the motors in connection with a brake and means operating by differential gearing between the motors for applying the brake the mechanism for operating the brake being thus dependent on a variation in the relative speed of the motors

Assorting Fruit by Weight In patent No 1,048,963, John B Hart of Austin, Colo, presents a machine for grading fruit in which there is a series of scales for assorting fruit of different weights and means are provided for conducting the fruit to the scales so that in the operation of the scales the heaviest specimens of fruit will be dropped first and the lightest specimens will be dropped last, thus securing a grading of the fruit by the weight of the respective specimens

Honors to Berliner —Mr Emil F Berliner of Washington D C whose long line of important inventions beginning with his telephone improvements and extending through the graphophone and sound reproducers, have made him famous as an inventor and who of late years has devoted much time and energy to philanthropic work, has received the Franklin Institute gold medal for his work toward the betterment of living conditions, the medal being one of six given annually Mr Berliner had already received, by the recommendation of the Franklin Institute, the Scott medal in bronze from the city of Philadelphia.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

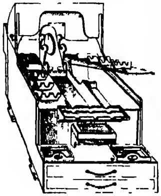
Of General Interest

BERRY BOX FORMER.—W. H. ELLIS, Coeur d'Alene, Idaho. This invention relates particularly to formers for berry boxes which are shipped flat and are folded into box form just previous to use, and has for an object the provision of an improved structure which will permit the quick folding or assembling of berry boxes of various sizes without breakage or distortion.

UNDERCUT SAW GUIDE.—I. W. DONAHUE, Pe Ell, Wash. This saw guide is adapted to so support the saw as to form a kerf at the under side of the log with the saw inverted. Devices of this character include generally a spike or dog to be driven into the side of the log and a guide arm adjustable on the shank of the spike and carrying a friction roller forming a rest and guide for the inverted cross-cut saw.

RECORDING INSTRUMENT.—A. F. BENSON, care of Mesaba Eng. Co., Virginia, Minn. This invention relates to instruments for determining the dip and bearing of drill holes and from which permanent photographic records may be obtained of the existing conditions encountered as the instrument is lowered down into the drill hole.

CABINET FOR DESK IMPLEMENTS.—G. DE LA TORRE, 4a de Rosabado No. 100, Mexico, Mexico. This invention is an improvement in cabinets for portable use adapted to hold the materials and the utensils used in writing, as for instance paper, envelops, pen and ink and



CABINET FOR DESK IMPLEMENTS

the like, so arranged that all of the materials and utensils may be held in a relatively small space, making an easily portable cabinet. The illustration shows a perspective view of the improved cabinet open.

SYRINGE HOLDER.—G. CHIAPASSO, Turin, Italy. The present invention relates to syringe holders, and the object of the invention is to provide a spring controlled syringe holder so arranged that the use of syringes for injections by any person is rendered easy without inconvenience.

METALLIC PARTITION.—A. H. IRVINE, Rochelle Park, N. J. The object of the invention is to provide a new and improved metallic partition for use in offices, stores, and other places, and arranged to permit of readily assembling the parts in a correspondingly short time and to render the partition exceedingly strong and durable.

CONTAINER AND DISPLAY DEVICE.—W. W. HUDLEY, R. 327 Knickerbocker Theater Bldg., 1402 Broadway, New York, N. Y. The invention pertains generally to a display device adapted when in knock-down position to serve the purpose of a container, the construction being made up of folding parts of simple construction whereby an efficient structure may be produced at a trifling cost.

SUPPORT FOR CONCRETE REINFORCEMENTS.—C. A. KORNMAN, 511 Walker Bldg., 5th and Market Sts., Louisville, Ky. This invention pertains to means for supporting concrete reinforcements and has for an object to provide a structure which not only supports the reinforcements at the desired place but acts as tying means for connecting the various parts together.

MEDICINE DROPPER.—C. F. HYDE, 4103 State St., Chicago, Ill. The intention in this case is to provide a bottle which is more effective for its purpose than those commonly employed and which will be substantially air tight when not in use as a dropper so that the contents of the bottle will be properly preserved.

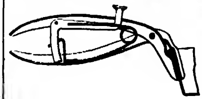
NON-REFILLABLE BOTTLE.—S. FISCELLA, 1646 Lexington Ave., New York, N. Y. This invention relates generally to non-refillable bottles, and the principal object is to provide a device of this class which will be extremely simple and at the same time adapted to be substantially non-refillable whereby a commercially successful article may be set forth.

AQUARIUM ATTACHMENT.—H. A. ROGANS, Pagosa Junction, Colo. The invention relates to aquarium attachments, and it has for its object to provide convenient means for supplying the aquarium with air, and for establishing a circulation of water therein which may be readily removed from the aquarium tank and be cleaned.

NON-REFILLABLE BOTTLE.—W. H. BOCK, Corona, Queens, New York, N. Y. A stop is provided near the lower end of the neck, to which the device is connected, and a valve structure arranged above the stop. This structure is formed with a freely reciprocating valve member actuated by gravity and also by the flow of liquid in either direction, the flow in one direction causing the valve to be unseated for allowing the fluid to flow from the bottle, the fluid flowing oppositely causing the valve to be seated against the action of gravity, whereby liquid is prevented from entering the bottle. Arranged between the valve structure and the outer end of the bottle are a plurality of baffling members, stops, etc., which prevent tampering with the valve structure.

Hardware and Tools.

TOOL.—J. STURTEVANT and J. T. WEINZIERL, 1106 3rd Ave., New Kensington, Pa. This invention is more particularly intended for embodiment in detachable handles for cooking utensils, but is capable of embodiment in



TOOL

pliers and other gripping devices. A spring between the crossed handles of a pair of gripping jaws tends to close the jaws, a novel ratchet and spring pawl on the handles hold the jaws in closed position.

DRILL EXTRACTOR.—W. L. HATHEL and T. STOETZEL, care of Theo. Stoetzel, 1528 Vyse Ave., Bronx, N. Y., N. Y. This invention has reference to drill extractors, and has for an object the provision of an improved structure for engaging broken drills or drills of any kind and quickly removing the same from the hole or bore in which they are found.

LUBRICATOR FOR HANDSAWS.—T. RICHARDSON, 2010 Perdido St., New Orleans, La. This inventor provides a lubricator and oil cup for handsaws and similar tools and is arranged to insure proper oiling of the saw blade and to allow convenient and quick attachment of the lubricator to the saw blade or to allow removal therefrom.

Heating and Lighting.

BOILER.—A. P. LINK, 237 President St., Brooklyn, N. Y. Mr. Link's invention refers to boilers, his purpose being to improve the general efficiency of apparatus of this kind, the object of the invention being to facilitate the capture and removal of mud or other residuum from within a boiler.

Household Utilities.

SHADE ROLLER.—G. R. GASON, care of The Anderson Mfg. Co., Coffeyville, Kan. The object here is to construct a shade which may be accurately and readily adjusted in place without the use of any screws or nails or any other attachments. Further to so construct and arrange the shade that it may be placed in any position on the framework of the window so as not to interfere with the opening of the window for ventilation or other purposes.

SHADE ROLLER SUPPORT.—W. COCKCROFT, 185 So. 4th St., Brooklyn, N. Y. This invention has reference more particularly to a shade roller device which comprises an elongated member, a bracket adjustable longitudinally of the member and having means for supporting a shade roller, and a clamp associated with the bracket and adapted to secure the same in different positions along the member.

DEVICE FOR LOCKING AND UNLOCKING WINDOW BLINDS AND DOORS.—J. C. PURCELL, P. O. Box 539, Beaumont, Tex. An object of this improvement is to provide means for opening a locked door or window blind from the sidewalk, especially in the case of fires, these doors or window blinds generally being bolted on the inside, thereby preventing the firemen from gaining access to the different floors of the building.

SHOWER BATH APPARATUS.—J. R. LANGLEY, 230 Stoner Ave., Shreveport, La. The purpose here is to provide a metal, economical portable extension shampoo and shower attachment, with practically no wearing parts, one that can be closed so as to permit of being carried in an ordinary suit-case, easily and quickly attached to any standard combination hot and cold water cock, and extended to provide for the desired bath.

CLOTHES LINE.—D. J. LAHAY, care of J. F. HAGEN, Calumet, Wis. This improvement provides a line having means incorporated in the construction for holding articles of laundry for drying; provides means for holding said articles at suitably close intervals; minimizes the weight of construction of the line, and minimizes the cost of construction of the same.

WASHBOARD.—W. O. DALY, care of Lerio Turpentine Cup Co., Mobile, Ala. The purpose here is to provide a construction of washboard in which the rubbing surfaces will be reinforced and can be readily removed and replaced, the whole being constructed to furnish a board which can be conveniently supported for use.

OPERATING DEVICE FOR WINDOW SASHES.—P. F. FITZ GERALD, 230 Bainbridge St., Brooklyn, N. Y. This invention provides a device for window sashes, arranged to enable the operator to readily raise or lower the sashes one independent of the other and without much physical exertion on the part of the operator, to securely hold the sashes in their adjusted position and to permit them from sticking or canting while being raised or lowered.

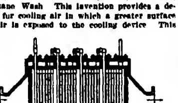
Machines and Mechanical Devices.

STAVE JOINTER.—J. J. KROHN, care of Humboldt Cooperage Co., Arcata, Cal. This invention relates to automatic machines for jointing barrel staves. The machine will automatically joint the edges of the barrel-staves in such a manner that narrow and wide staves shall have the proper bevel at their edges. The feeding means prevent substantial lateral movement of the staves during the cutting operation.

TRANSMISSION MECHANISM.—T. P. STEADMAN, care of State Savings Bank, Niles, Mich. The invention relates to a power transmission mechanism for generators or wherever a positive uniform drive is desired from a spasmodic or non-uniform drive. An object is to cushion the sudden acceleration of spasmodically rotating members to, in effect, store the unevenness of power so that it may afterward be utilized over a long period of time which in the case of the generator will produce a steady even current.

MACHINE FOR USE IN THE MANUFACTURE OF INCANDESCENT GAS MANTLES.—J. I. ROBIN, 121 Bollo Bridge road, Acton, London, England. This invention has more particular reference to a machine for finishing mantles formed upon the machine forming the subject matter of Mr. Robin's co-pending application Serial No. 585,992, of which this application is a division. The object is to provide an apparatus whereby the half completed mantles formed by the machine may be readily and rapidly completed without necessitating the use of skilled labor.

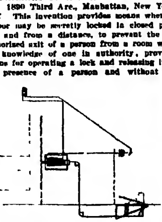
AIR COOLER FOR AIR COMPRESSORS.—H. R. MACLAMY, care of Union Iron Works, Spokane, Wash. This invention provides a device for cooling air in which a greater surface of air is exposed to the cooling device. This



AIR COOLER FOR AIR COMPRESSORS.

is attained by means of a perforated partition and a series of pipes which are so disposed as to break up the air into minute particles, at the same time causing these particles to pass into contact with the cooling surfaces.

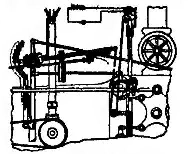
AUXILIARY LOCK FOR DOORS.—A. NATHMAN, 1890 Third Ave., Manhattan, New York, N. Y. This invention provides means whereby a door may be secretly locked in closed position and from a distance, to prevent the unauthorized exit of a person from a room without knowledge of one in authority, provides means for operating a lock and releasing it in the presence of a person and without his



AUXILIARY LOCK FOR DOORS.

knowledge; provides an audible alarm operable by the lock when closed, and means for operatively controlling the alarm, and provides a durable mechanism for operating the lock. During warm weather when the door is open there is an attachment that closes the door and permits the lock to operate in the door. As a protection during the night in case anyone should enter the store and trespass near the safe, the lock automatically locks the door, thus preventing the person's escape, besides giving an electric bell alarm outside the store.

CONTROL FOR ENGINES.—H. J. PARCHMAN, Box 632, Anacortes, Wash. This invention relates more particularly to manually controlled mechanism which comprises a member having means whereby the admission valve may be so adjusted as to vary the speed of



CONTROL FOR ENGINES.

the engine from the normal to a complete stop without closing the throttle valve or adjusting the governor. In connection with a magnet the engine may be stopped completely from any desired place without closing the throttle valve of the engine, and the governor can be made more sensitive when the engine runs normally.

Railways and Their Accessories.

RAILWAY RAIL ATTACHMENT.—W. HASKINS, 35½ Chestnut St., Hartford, Conn. This attachment serves not only to prevent the rail from shifting laterally or canting, but also to support the cross-ties. To this end the in-

RAILWAY RAIL ATTACHMENT

vention consists of a post having its lower portion embedded in concrete and projecting a substantial distance above the ground, an angle-plate on which one end of the adjacent cross tie seats, bolted or otherwise attached to the upper portion of the post and seating on the ground, and an elbow attached to the angle plate and to the rail web.

CATTLE GUARD FOR ROADWAYS.—J. A. STEPHENSON and S. J. BILLINGTON, care of Billington & Anderson, Elliston, Mont. The invention provides suitable bars and a yielding apron adapted for disposition in pathways which could be traveled by cattle which apron and bars would operate to trap or discompose cattle on trying to cross the same, and provides a bar structure quickly and readily arranged or mounted in service position.

Pertaining to Vehicles.

RESILIENT TIRES FOR WHEELS.—E. L. A. DUVIAS, 17 Place de la Madeleine, Paris, France. This invention relates to an improved resilient tire for vehicle wheels of all kinds, which comprises two circular bands or rings placed the one around the other and connected together by a cover of rubber or other similar resilient material under tension.

AUTOMOBILE PUMP.—R. A. GOETH, P. O. Box 199, San Antonio, Tex., R. B. Rodgers and J. A. Dittmar, San Antonio, Texas. An object of this invention is to provide a pumping attachment, which is attachable to any wheel regardless of the size and form of the hub, or the absence of any projection of the hub beyond the face of the wheel. A further object is to provide means so designed as to permit of securing the attachment to such wheels as are provided with large brake drums.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 9299. Wanted the names and addresses of concerns who can turn irregular shaped handles in wood, similar to gunstock work.

Inquiry No. 9300. Wanted name and address of [illegible] of a machine for driving steam pipes into [illegible]

Inquiry No. 9301. Wanted the name and address [illegible]

[illegible]

Stereoscopic Views of Lightning

(Concluded from page 265.)

lightning has, we believe, been photographed only once, though there are many pseudo-photographs of this phenomenon.

Two years ago, Prof. B. Walter of Hamburg published in the Year Book of the Scientific Institutes of that city several double views of lightning obtained with a stationary and a mechanically moved camera, respectively. These double views were mainly intended to ascertain the time connection between atmospheric discharges occurring at different points of the sky, though practically at the same moment. In working out these views, a want was frequently felt for learning not only the time connection, but the space relation of such "correlated" flashes of lightning, which induced Prof Walter to utilize in his recent researches not two, but three photographic cameras, one of which was as formerly moved by clock work, whereas the two remaining were fast on a wooden lath at about 2 meters distance, being adjusted with their axes parallel to one another by means of two graduated circles.

As pointed out in a paper submitted to the recent Congress of German Natural ists and Physicians, the views taken by means of the last named two cameras, one of which is shown in Fig. 1, allow the distance of each lightning flash from the observer to be ascertained. Furthermore, each of these pictures, in conjunction with the third one, viz., the picture obtained with the movable camera (Fig. 2), will give any time difference between the various discharges. On the other hand, the two pictures obtained with the stationary camera, provided the difference between the latter bears a proper ratio to the distance of lightning flashes, are very well adapted for stereoscopic inspection.

Some excellent pairs of stereoscopic pictures of this sort have been obtained in the course of last summer, and as these would seem to be the first of their kind one is reproduced in the accompanying figures (Figs. 3 and 4), while the correlated picture, obtained with the movable camera, is shown in Fig 5.

On examining Figs. 3 and 4 in the stereoscope, those branches which in each individual picture cross one another are seen to be entirely separated in space and accordingly, to be entirely independent branches of the main flash. Stereoscopic inspection also shows that in the present case, far behind the strongest left-side ramifications of the main flash, another self-contained flash of lightning has occurred whose origin in the cloud is readily found, which has turned to the left in order, it seems, to terminate in another cloud. From the dimensions of the original picture the distance of the main flash of lightning from the observer is found to be about 500 meters, and that of the flash of cloud lightning several kilometers. That the latter really is a discharge entirely independent of the main flash of lightning is, by the way, borne out by the third picture of the phenomenon, the one obtained with the movable camera (Fig. 5), the main flash of light ning being practically instantaneous, while the cloud lightning is made up of two partial discharges, with maxima following up one another at 0 0005 second interval. By comparing the third view with the two stereoscopic pictures, the main flash of lightning is found to coincide to less than 0 001 second with the last partial discharge of the hindmost cloud lightning, thus proving with nearly absolute certainty an electrical connection between two discharges entirely independent in space.

Life-boat and Deck-seat Combined.—A novel form of deck-seat is shown in the patent, No. 1,049,513, to Thomas J Murphy of Needles, Cal., and consists of a boat-like structure which may be turned upside down to provide seats back to back with the back of the seat formed by the stationary keel of the boat, a sliding keel being connected to the stationary keel so it may be readily adjusted to position for use when the deck-seat is inverted in the water.

Gasoline and Its Substitutes

A Great Problem and Its Solution

THE price of automobiles is going down but the price of gasoline is going up The wholesale price in New York is now 17 cents a gallon. A year ago it was 9 and 10 cents, but rose to 16 cents by July, 1912. The relation of kerosene to gasoline has been strikingly reversed In former years there was so little demand for gasoline that it was an almost valueless by-product in the mineral-oil industry, and therefore as much as possible was left in the kerosene This, however, increased the explosibility of the latter and the consequent danger of its use States passed laws to safeguard the lives and property of their citizens by prescribing the flash point and burning point of kerosene, and it was the duty of the State-oil inspectors to see that the kerosene offered for sale came up to the required standard

At the present time gasoline is worth about twice as much as kerosene and now it is gasoline that is adulterated with kerosene

The United States is fortunate in having great oil fields within its borders, being excelled only by Russia in this respect In other countries the situation is more acute Gasoline in Germany sells for 40 cents a gallon The International Association of Recognized Automobile Clubs has offered a prize of $100,000 for a fuel which may be used as a substitute for gasoline, and a British Society one of $10,000

Relief may be found in any one of three ways

1 By increasing the gasoline supply

2 By devising apparatus—carbureters—capable of utilizing other fuels such as kerosene, naphthaline, crude oil, vegetable oil, alcohol, etc

3 By compounding or discovering a new fuel which can be used in the engine just as gasoline is now used i e, without any substantial modification of the engine or its carbureter It is toward the solution of the last stated problem that the prize above mentioned has been offered

For a better understanding of the gasoline question it may be briefly stated that crude petroleum, by a process of fractional distillation, may be separated into a multitude of component oils differing from each other in insensible gradations The aim is to produce the maximum yield of three principal products for which there is the greatest demand, these being kerosene of 43 to 47 deg Be gravity, naphtha of about 42 degrees gravity, and automobile naphtha, or as it is now more commonly called, gasoline of about 68 degrees gravity Kerosene, naphtha and gasoline constitute about 60, 4 and 10 per cent respectively of the crude petroleum However, due to the unsettled state of the nomenclature of the mineral oils, these products sometimes go under modified names, particularly the "gasolines," which are to-day extensively sold under gravities considerably less than has been customary some years past. However these products may be named, the fact remains that they, as ordinarily found in commerce, are really unseparated mixtures of higher and lower gravity oils, their components being so proportioned that the average gravity corresponds to the gravity of kerosene, gasoline, and the like.

Leaving out of consideration the opening up of new oil fields, other sources of gasoline have been searched for An interesting source of gasoline and process of recovering it is as follows

As well known, natural gas is found in enormous quantities in some of the oil regions. Now this natural gas contains a small quantity of naphtha vapors Naphtha may be defined as including all hydrocarbons, and each of them, which are liquid at ordinary temperatures and atmospheric pressure, and which have lower boiling points than the normal hydrocarbons of burning oil (kerosene). The natural gas may be said to be carbureted with naphtha. While this quantity of naphtha, as stated, is small, and the amount varies in the gas from different oil wells, yet in the aggregate a large quantity of naphtha is daily burned or lost along with the other constituents of natural gas. In order to recover this naphtha the gas is first cooled and then passed through absorbing towers where it comes in intimate contact with descending streams of a "menstruum." For the latter the following substances may be used, hydrocarbons whose boiling point is separated by a considerable temperature interval, say 100 deg Fahr from naphtha, fatty oils, amyl alcohol and others. The naptha thus absorbed is separated from the menstruum by fractional distillation If the absorbed naptha is to be separated otherwise than by distillation from the menstruum enriched thereby, a menstruum must be used capable of such separation Such are ethyl alcohol sufficiently anhydrous, acetone, mixtures of acetone and methyl alcohol These absorb naphtha and on dilution with water part with it. Therefore it is only necessary to add water to the menstruum saturated with naptha, whereupon the naphtha will separate out as a supernatent layer which is decanted off

Another method of producing gasoline is by converting kerosene into gasoline The oils, it should be recalled, are hydrocarbons belonging to the paraffine series corresponding to the formula $C_n H_{2n}+2$. Kerosene is composed of a mixture of the higher members of the series, gasoline of the lower Now if a reaction like the following ($C_{16}H_{34}=C_8H_{18}+C_7H_{16}+C$) could be effected, which means that one molecule of a higher member is broken up into two molecules of lower members, splitting of some carbon as residue, the problem would be solved, provided the process could be carried out commercially Now this very process, called "cracking," is carried out in breaking down the members above the kerosene members, by superheating them in the distillation process The yield of kerosene is thereby increased Unfortunately the breaking down of the lower members of the series into still lower ones appears to offer greater difficulties. However, a patent has recently been granted for a process of converting kerosene into naptha or gasoline by subjecting the kerosene to the powerful influence of properly applied decomposing temperatures, ranging from a visible or cherry red to a full white heat The heat is applied by means of a submerged electric heater An electrode of heat-enduring material, submerged near the surface of the oil is maintained at an incandescent temperature by a low-voltage, high-amperage electric current. The vapors evolved are withdrawn and condensed The condensed distillate contains a mixture of light oils and heavier still, unconverted oils. They may be separated by fractional distillation, or the mixture may be subjected to successive treatments with the electric heater This process of "cracking" the heavier oils relieves them of more or less carbon, which is deposited on the hot electrodes and partly held in suspension and gravitating toward the bottom of the convertor

The use of kerosene, crude oil, even vegetable oils as a substitute for gasoline, offers comparatively little difficulty in engines that operate on the hit or miss principle, that is where a uniform charge of air and oil is drawn into the explosion chamber of the engine. But in the automobile engine, where the charge is controlled by the throttle valve, far greater demands are made on the carbureter to furnish the most desirable mixture of oil vapor and air for varying conditions of speed and load. The problem of devising a reliable efficient carbureter is greatly complicated when it is proposed to use kerosene, crude oil, paraffine, napthaline, etc. The latter two are solid at ordinary temperatures and must therefore first be liquified. Carburetors designed to use such fuel have been patented, but whether they will operate as successfully as their inventors claim, remains to be seen. It is well known that kerosene may be used after having started and warmed up the engine with gasoline. It will be found, however, that kerosene soon [illegible]

"cracking" of the kerosene caused by the high ignition temperature It is proposed to overcome this difficulty by injecting a small quantity of water along with the charge The water is converted into steam, thereby lowering the initial temperature and preventing the "cracking" and the consequent carbon deposit But it is obvious that the necessity of the water injection again complicates the problem of the carbureter

The compounding of a new fuel resembling gasoline in its physical properties must meet the following demands Its exhaust gases or products must not attack the cylinder, the explosion must not be too violent, it must leave no solid residue, and last but not least it must be cheaper than gasoline and the supply of its base or main ingredient must be so abundant that even an enormous demand therefor will not raise its price to any extent The last requirement rules out with one sweep all vegetable and animal oils and fats This would confine us to hydrocarbons and their derivatives obtained from mineral oils, distillation products of carbonaceous material, coal tar, alcohol, etc

In Germany industrial alcohol, being lower in price than gasoline, the latter selling at 40 cents, is used as a base for the new fuel In this country industrial alcohol has not as yet realized in any measure the high hopes entertained at its introduction As it is considerably higher in price than gasoline it offers no prospect of being of any aid in the solution of the gasoline question Several patents have been granted in Germany covering interesting and suggestive processes. One proposes to increase the power and explosibility of alcohol by the addition of mono nitro-benzol Another process is to dissolve a small quantity of acetylene gas, as little as 0 2 to 0.5 per cent of acetylene by weight of the new fuel mixture being sufficient to increase its power and explosibility considerably At 0 deg Cent and 760 millimeters atmospheric pressure, gasoline absorbs 4 to 5 per cent of acetylene, kerosene 1 5 to 2 per cent, alcohol 5 to 6 per cent, and acetone 30 per cent Therefore, using acetone saturated with acetylene for dosing the fuel base, such as alcohol or kerosene, the desired result is obtained, acetone being miscible with the mentioned fuel bases.

A new process, recently patented in Germany, is still more promising A mixture of alcohol, kerosene, coal tar oil and coal tar is distilled at a high temperature. Thirty-six parts of the resulting distillate 100 parts of 94 to 95 per cent alcohol, 2 parts of distilled wood spirits—all parts being by weight—are distilled between 66 to 70 deg. Cent until no more vapors pass over About 12 per cent of the mixtures is thus distilled over The remaining 88 per cent is cooled to 10 deg Cent. About 8 per cent of paraffine and naphthaline are thus precipitated out and removed by filtration The remaining liquid constitutes an alcohol highly carbureted, which contains neither substances excessively explosive nor those which precipitate out in the cold For automobile use 64 per cent of this resulting liquid is mixed with 36 per cent of the light distillate obtained in the distillation at 66 to 70 deg Cent. This new fuel, it is claimed, is an excellent substitute for gasoline.

Measuring the Flow of a Stream

(Concluded from page 269.)

theoretically from a reach of river ten miles long having an even gradient of 5 feet to the mile, as from a clear drop of the river of fifty feet at one point, although in rare instances, owing to the topography of the river banks it may be cheaper to extract power from rapids than from a straight fall

The question of flood water storage is also a vital one in considering the maximum power of any stream. This is a great and fascinating department in itself. The storage of water in natural mountain reservoirs, of which many streams have a good supply, smacks of the providence of the thrifty husbandman who in time of plenty lays up a store of provisions against the season of hardship which he foresees.

Where storage of water for power purposes is effected, it is evident that the greater the fall the more valuable is the reservoir. A reservoir containing 2,542,600 cubic feet of water, or a little more than 3¼ acres 16 feet deep, if it has a fall or series of falls of 1,640 feet will produce 10,000 horse-power the year through. On the other hand, if the fall is but 16.4 feet, the reservoir to produce 10,000 horse-power will need to hold 254,260 000 cubic feet of water, or be over 350 acres 16 feet deep, or 35 acres 160 deep.

Water is the country's greatest resource. Coal, oil and other power producers are exhaustible, but the use of water, never. So long as rain and snow fall moisture is evaporated and clouds formed and their particles precipitated again, so long the endless chain will revolve and streams can be employed for power, irrigation and navigation in their travels from mountain heights to ocean level over and over, again and again. But we should know our rivers more thoroughly, and eventually we should control and utilize them with almost the certainty that is attained in the handling of a city water supply. Where the Government has now one gaging station, it should have a dozen.

The Chemistry of a Soldering Flux

THE action of a flux during the operation of soldering consists, briefly, in cleansing the surfaces to be soldered, keeping them clean, and letting the solder make contact with them.

The impurities generally occurring on metallic surfaces are grease or other organic matter and oxides. An effective flux must have the power of dissolving all those and flooding them out of the way.

Zinc chloride is the flux most commonly used. It fuses upon the surface at a low temperature, and dissolves organic matter with great readiness. It removes oxides by converting them to chlorides of low melting points, which flow out of the way, either alone or in solution with the fused zinc chloride. The chloride of iron even volatilizes to a considerable extent. Zinc chloride is usually applied in water solution. But its flowing power and its cleansing action are increased when it is used in solution in some alcohol, fatty acid, or oil such as oleic acid or castor oil. With all these solvents it combines in large proportion to form thick, syrupy liquids with high boiling points. The cleansing action is improved by the solvent, which dissolves metallic oxides and chlorides.

Ammonium chloride in solution in glycerine is frequently used as a flux, and is especially suitable where a very clean job of soldering is necessary, since these materials are driven off by heat and leave very little residue. The action upon organic impurities is not so strong as that of zinc chloride but the glycerine flows very readily, and readily dissolves the chlorides formed by decomposition of the ammonium chloride, so that this mixture is a very effective flux.

Of the organic fluxes, rosin is perhaps the one most commonly used. It is most effective for soldering tin and lead surfaces. It owes its efficacy in cleansing to its ability to form soluble resinates with tin and lead oxides. Similarly, various oils and fatty acids, such as palm and castor oils, oleic and stearic acids, have value as cleansing agents and make good fluxes.

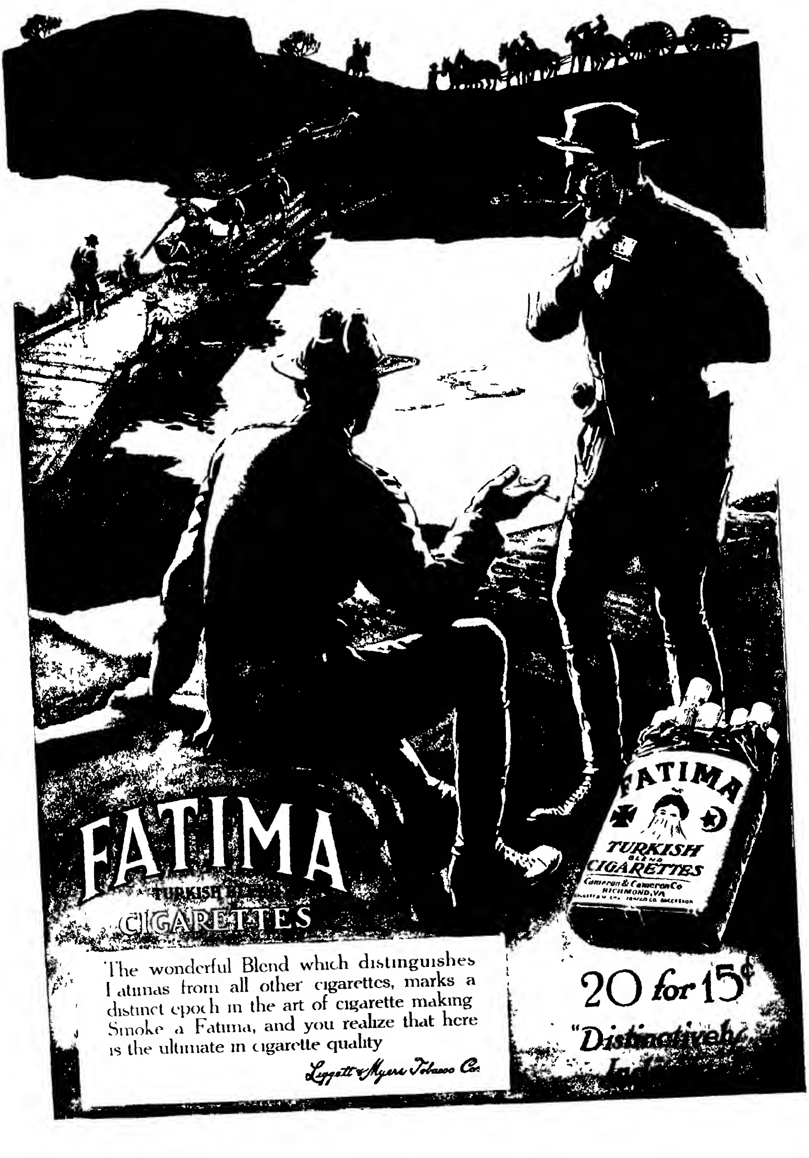
The physical properties of a material also determine its usefulness as a flux. Its viscosity should be light enough at the melting temperature of the solder to permit of a free flow on the surface. Its surface tension in contact with the heated surfaces and melted solder should be quite high. This is a vital characteristic. That is, these surfaces should not be easily "wetted" by the flux. The importance of this may be seen by comparing the fluxing power of a petroleum oil with that of rosin. It will be seen that the mineral oil wets a globule of melted solder completely, while the rosin shows a negative tendency. The oil forms a film which separates the solder from even a clean metal surface, while the rosin film breaks, lets the solder touch the metal, and even draws the two together.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12759) J. F. M. asks: Will you please advise me as to what chemical action takes place when a volume of gas is exploded by an electric spark? A. A volume of gas which can be exploded by an electric spark must be a mixture of the oxygen of the air with some combustible gas. The spark of electricity starts the combustion and the fire spreads quickly through the whole mass.

(12760) L. S. asks: The usual explanation that it is the attraction of one body for another does not explain anything. What I wish to know is whether gravitation is a force apart from other forces or whether it is electrical (magnetic) or something of the sort, and whether it is supposed to act instantly at all distances or has a definite rate of travel. A. The nature of gravitation is unknown. It exhibits itself as an attraction between the particles of matter. It is different from and acts apart from other great forces of nature, electricity, magnetism, etc., and it acts instantly, not flowing with a velocity which would require time for it to cover a space. 2. What is evaporation? My theory is that most liquids and some solids are soluble in air and other gases just as solids are soluble in liquids. Am I right? I have looked in vain for a satisfactory explanation of the above questions. Can you put me right? A. Evaporation is the passing of the molecules of a liquid or solid into the vapor state. Air is not necessary for evaporation. It takes place with much greater rapidity in a vacuum. Some solids evaporate in a vacuum which will melt in the air. Air retards evaporation. Evaporation is explained by the kinetic theory of matter—that the molecules of all liquids are in vibration, those at the surface for this reason can escape from the surface and then are vaporous. Heat and not solution explains evaporation. See Carhart's "College Physics," which we send for $2.40 postpaid.

(12761) C. P. L. writes: In your issue of December 21st, 1912, in answer to inquiry 12717 by J. A. B., I note your explanation with reference to the electrolysis of water, and the jocular manner in which the subject is handled. Water, that is H_2O, is extremely difficult to ionise, and the inability of pure water to conduct electricity is caused by the fact that it is the ions only which conduct the current, and I venture to state that it is not the ions of the water which appear at the respective poles as gas. I should be pleased, therefore, to see a more correct explanation, or to be shown wherein the following explanation is wrong. When sulphuric acid is added to water the substance produced is dilute sulphuric acid. As such the ions are those of sulphuric acid, viz. H_2 and SO_4. Now the SO_4 ion, which carries a negative charge, gives up this charge upon contacting with an unattackable positive electrode. Immediately it recombines with a molecule of water to form H_2SO_4 (sulphuric acid), thus liberating the atom of oxygen from the molecule of water with which it has become associated. At the negative pole the diluted sulphuric acid has the SO_4 ion repelled, as it carries a negative charge, and the H_2 ion, carrying the positive charge, gives up its charge, and the gas appears as hydrogen. The hydrogen, having given up its charge, cannot recombine with the SO_4 to form sulphuric acid. A. We thank you for your letter and the interest you take in the completeness of the answers in Notes and Queries. It would, however, have defeated our end if we had made an answer to the correspondent in question and given an explanation of the electrolysis of water which involved sulphions, the lack of ionization of chemically pure water, the primary and secondary electrolysis, etc., which are involved in this phenomenon as explained by the latest theories. He would be repelled by this method and would turn away from the paper in disgust, since he emphatically asked us not to give a technical explanation. Only a brief abstract of the letters are usually printed in the form of questions, and very often the personality of the questioner is lost in the condensation of his views. We have to decide how far we shall go in a particular answer, as we were in this instance. If we were disposed to criticise the statement above, we should find it as open to criticism as was ours. We should take decided exception to the claim that the oxygen and hydrogen which appear as gases do not come from the water. They cannot come from the acid, for that is not used up in the electrolysis, and the water is used up. They can only come from the water, though they pass through the acid on their way. Nor should we say that the sulphion recombines with a molecule of water. It displaces the oxygen of the water, and takes its hydrogen to form a new molecule of sulphuric acid, and in turn gives it up in ionization, so that the ionization is continuous, and both hydrogen and oxygen molecules, not atoms, as the letter says, appear at the two poles. We are quite willing to give our esteemed correspondent his opportunity to teach this inquirer, but after all think our mode of stating the case to be the better for the beginner, and this, too, after many years in the professor's chair teaching this subject to students.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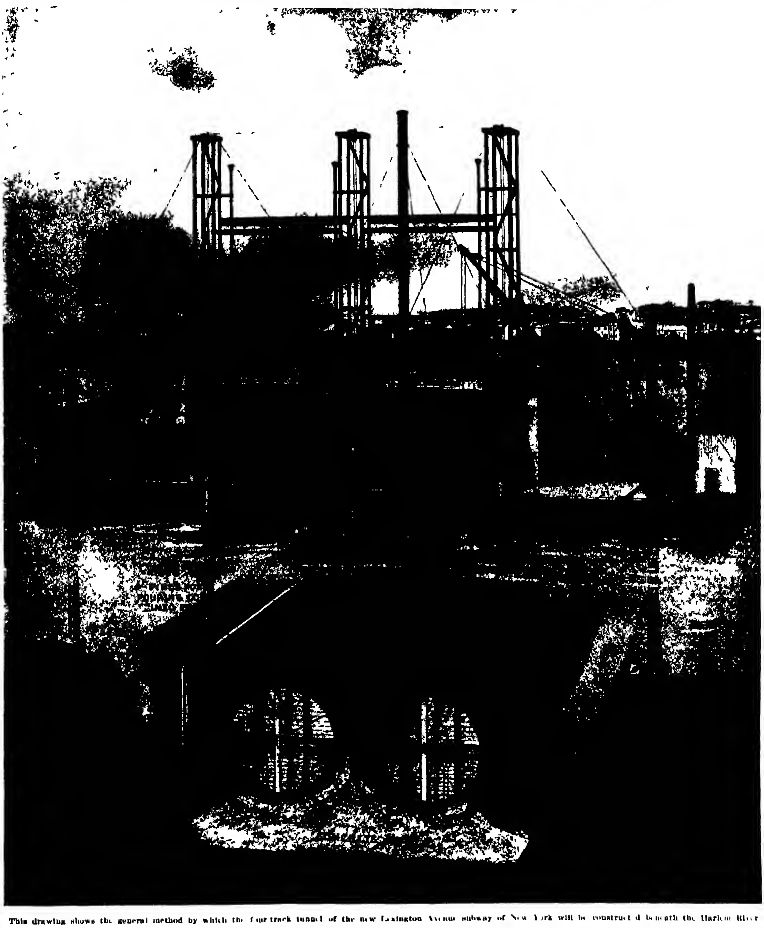

This drawing shows the general method by which the four-track tunnel of the new Lexington Avenue subway of New York will be constructed beneath the Harlem River

TRENCH-AND TUBE METHOD OF CONSTRUCTING SUB AQUEOUS TUNNELS —[See page 286]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement.

Reorganization of the Navy Personnel

ONE of the most urgent needs of the Navy at the present time is a thorough reorganization of its personnel. To be convinced of this let us consider a few of the basic facts which underlie any efficient military organization, naval or otherwise.

In a naval establishment there must be sufficient men and officers to man the fleet. Twice as many ships would require approximately double the number of personnel. In other words, there should be a definite relation between the tonnage and the personnel. Axiomatic as this fact is, the present conditions do not recognize it.

Having arrived at the definite number of officers needed, it is then necessary to distribute them in proper proportions in the different grades. A single battleship requires but one captain, yet about forty junior officers are necessary to carry on the duties of the ship. Not only must the officers be proportioned in the various grades, but in order that they may obtain the proper experience and not be too old to perform the duties incident to each grade, the length of time they serve in each grade must be fixed. If the country is to obtain maximum efficiency for the money expended on the personnel, officers must be promoted at reasonable ages and not stagnate too long in any one grade. The present law does not consider this point at all.

Above all, the flag officer on whom the fate of battles depends should reach his grade in time to thoroughly master his duties before retirement. Six to seven years is the amount of time deemed sufficient, divided in the grades of rear-admiral, vice-admiral and admiral. As matters now stand, the ensign gets his commission at about 22 years of age. He must retire at 62. Forty years is his official life, to be divided in the grades from ensign to admiral. The reasonable ages for promotion are: Lieutenant junior grade at 25, lieutenant at 28, lieutenant commander at 36, commander at 42, captain at 47, rear-admiral at 55.

In order to provide for promotions at the above ages, some scheme of elimination of the inevitable surplus of officers is necessary, and a very simple example will show that it cannot be avoided. Take one hundred graduates who enter the service as ensigns. Statistics show that as they advance 1 per cent annually are eliminated by casualty. With the above mentioned ages for promotion, this class of 100 would in 18 years arrive at the grade of lieutenant commander, and 58 of them would be still living. As only five of this number are needed for flag officers (5 to serve 7 years, making 35 flag officers) it is evident that 53 must be eliminated between lieutenant commander and admiral by casualty or selection. To keep down the expense which this number of eliminations would cost, a graduated retired pay is necessary, and it is proposed to retire the eliminated officers after 18 years' service at one third pay, gradually increasing the retired pay with length of service until it reaches three fourths pay after 31 years' service. This phase of the reorganization makes a new and efficient Navy cost no more than it does under the present inadequate system.

The creation of the grades of vice-admiral and admiral is a military necessity that has long been recognized, and is, of course, in line with the practice of all other navies of the world. They are not created for the personal benefit of any individual officer; the proposal would merely place the United States in its proper relation to other nations possessing fleets of war. In combined fleet operations this is a matter of great importance. In foreign services over 40 per cent of the flag officers are of higher rank than rear-admiral. The present law temporarily allows but one in the United States Navy—Admiral Dewey, who is past the sea-going age.

The feature that is of especial interest in the proposed reorganization is the amalgamation of the Pay and Construction Corps with the line. This is distinctly a progressive measure, in line with advanced thought. It is not intended to make all line officers paymasters or constructors, but it aims eventually to make all paymasters and constructors line officers. After a period of specializing, line officers will be detailed for those duties and all officers on board ship, except the surgeons and chaplains, will be combatant, i. e., line officers.

The graduates of the Naval Academy already specialize in engineering, ordnance, electricity, torpedoes, and mining. It is proposed to add naval construction and paymaster duties to their fields of activity. The gain will be enormous in flexibility, absence of corps friction, and unity of purpose. The Navy will present a solid front. It means team work of the highest order. Efficiency must, of necessity, follow. The bill proposed by the Navy Department will accomplish the above desirable results and, in addition, will safeguard the interests of the medical corps, civil engineers and marines. No change is made in the advantages now held by the warrant officers and enlisted men, who still may obtain commissions by passing the required examinations.

The hopeless condition that now confronts the Naval service in regard to promotion is completely met by the proposed bill. Under the existing law the junior lieutenants will soon stagnate in that grade for 10 to 17 years, with no hope of reaching the commander's grade until 58 years of age. Such a condition is, of course, unthinkable and must be promptly met.

The advantages to be secured by the above reorganization are obvious and far reaching. It is the hope of the SCIENTIFIC AMERICAN that the friends of the Navy throughout the country will urge upon their Congressmen the necessity for the passage of the bill with the least possible delay.

It has been suggested that the measure is favored by naval officers because of personal considerations of advancement and profit. We speak from intimate knowledge when we assert that nothing could be farther from the truth. This bill is merely one expression of the earnest desire of the personnel to raise our Navy to the highest point of efficiency.

The New Haven Railroad Automatic Stop Competition

WE have received from the New York, New Haven and Hartford Railroad Company a statement of the present conditions of the competition of the $10,000 prize which they have offered for the best design of an automatic stopping device for installation on their railroad system.

When President Mellen made this offer, he scarcely realized the amount of work that the contest would entail or the strange and varied suggestions that would be submitted. To date, 1,574 applications have been received by the company, and to take care of them has entailed the services of a special force of employees. The company also obtained copies of the patent records of stopping and signal devices on file at Washington, and here they found that no less than 1,488 such appliances had already been patented.

"Applications," says Mr. Mellen, "have been sent in from all over the world: Panama, Porto Rico, Jamaica, Belgium, France, Ireland, Hawaiian Islands, England, Scotland, Wales, Germany, and Denmark are some of the countries represented in the contest. The competitors represent nearly every walk of life, from clergymen to jailbirds. Four of them are in jail, and an equal number are inmates of insane asylums. One has recently been indicted in Canada for attempting to sell stock in his stopping device company on false pretenses, and the United States post office authorities have also been investigating his stock selling scheme."

When the new devices began to come in, it was found that competitors had paid little or no attention to the instructions sent out by the company, and most of the plans had to be returned for further information. The SCIENTIFIC AMERICAN published the instructions and conditions of the contest in full in its issue of January 18th. The report before us reiterates the more important conditions of the competition. The company agrees to assist the competitor by contributions of money or use of tracks, or both, provided his device appears, in the judgment of Signal Engineer C. H. Morrison, to have sufficient merit to justify more extended consideration. The patent of the successful prize winner remains the property of the competitor, the company merely making the sole reservation of the right of use on all of its lines without further payment.

The principal mechanical and physical requirements are: first, that the apparatus must be such that the removal or failure of any essential part of it would cause the display of a stop signal and the application of the brakes. Second, it must be so designed that it may be used on the open railway, on bridges or elevated structures, in tunnels or subways, and where either steam or electricity is used as the motive power. The third and most important consideration of all is that the apparatus must not be made inoperative by snow, ice, sleet or freezing conditions. The company states that it is in the latter requirements that so many of the competitors' devices failed. Many others were thrown out by the fact that they called for overhead apparatus, which, for the New Haven Railroad, which is electrified over many miles of its system, is impracticable because of the overhead high voltage wires which exist on its electric zone.

Of the devices submitted, only about 5 per cent were deemed worthy of consideration, and of these two only met with sufficient approval to warrant experiments at the expense of the company. The engineers of the company report that these two are worthy of installation for trial in actual operation, and they believe that through experiments and investigations one of them may be brought to a state of efficiency sufficient to meet the specifications of the prize competition.

As was to be expected, many of the devices were ingenious, but not practical. As an example of the futility of most of them, says the report, one competitor wrote that his device would not constitute a source of danger to the passenger, although its application would probably kill the engineer and fireman, but as it was to be used on the New Haven road that wouldn't make any difference. The device of another competitor consisted of a heavy spring hook which it was claimed would automatically rise from the roadbed when a train passed a signal, catch hold of an axle on one of the cars, thereby stopping the train.

It should be noted, in conclusion, that the problem, so far as the New Haven road is concerned, is to devise some method of conveying information from the ground to the moving locomotive, and to do this with absolute certainty in all conditions of weather.

Our Increasing Middle Age Mortality

FOR many years the public has seen in life insurance merely a means for providing against the hardships which may come to the individual owing to the uncertainty of human life; life insurance companies, looking at the matter from their own standpoint, have used mortality tables and vital statistics merely as a means of gaging the health of their *clientèle*, and hence the "risk" attached to a given policy. Even with this restricted horizon before them, the public and the companies have derived great advantages from the existing system. But the world moves forward. To-day the companies are beginning to realize that a study of mortalities can be made to render most valuable services, benefiting the public and themselves alike; for in this the interests of both run clearly parallel that both gain by the prolongation of human life. Mr. Rittenhouse, Conservation Commissioner of the Equitable Life Assurance Society, discusses in our current SUPPLEMENT the alarming increase observed in middle age mortality in American communities. The seriousness of this phenomenon hardly needs emphasis. The middle aged man is the most valuable member of the community. What may be the cause of this increased mortality? The optimist is ready with the reply that the increase is merely apparent, or at least is the result of decreased infant mortality, whose beneficial effects more than outweigh the observed losses. For, it may be argued, if we protect our infants from the attack of the diseases, which until a few years ago made pitiless ravage among them, we shall save a comparatively few strong individuals (for most of *these* would have survived even under the old order of things), but a greater proportion of weaklings, who under the old *régime* would have been weeded out. The result will be that our adult population represents a less highly resistant stock, which therefore exhibits a higher death rate. While there may be some justification for this view, unfortunately evidence is altogether against our accepting it unqualified. In the first place the great improvement in the conditions of infant mortality is a matter of comparatively recent growth, so that its effect upon our middle-aged population can hardly, as yet, have become strongly felt. Again, comparison with English statistics shows that there the increase observed has been at most very slight, while in this country the increase in middle-age mortality within the last thirty years is estimated at no less than 20 per cent. Such increase cannot be accounted for as the mere result of the better preservation of human life in infancy, but must be ascribed, it seems, to the increased stress of modern life, and to other causes at present unknown to us.

Engineering

An Exhibition Highway.—The State of Washington will spend $8,000,000 during the next year on road construction; and in this connection it is interesting to note that an exhibition stretch of roadway is being built at Olympia, Washington, by various paving companies, each of which is laying a sample of roadway 16 feet wide and 100 feet long according to its own plans and specifications, which are filed with the State Highway Department. This stretch of roadway forms a part of the main highway north and south through the State.

Ice on the North Atlantic.—In addition to the work which will be done this spring and summer by one of our scout cruisers in patrolling the North Atlantic steamship routes and reporting the appearance of ice, the Board of Trade has announced that the "Scotia," formerly employed in the Scottish Antarctic Expedition, has been placed on the same service The "Scotia" carries a long-range Marconi wireless plant, which will enable her to keep in touch with the stations at Newfoundland and Labrador The cost of this scout service is shared jointly by the principal Atlantic lines and the British government.

An Automatic Stop Failure.—The report of Sir Arthur Yorke on a recent failure of an automatic stop on one of the tube railways of London makes it clear that the general principles of the automatic stop were not at fault As compared with practice in this country, both the design and the upkeep were faulty It was found that one of the brackets supporting the rocking shaft on which the stop arm is mounted was loose. Furthermore, the principle of control was wrong In American practice, both the stop and the signal arm go to the danger position by gravity, should the service be broken or short-circuited. In the case of the London tube installation, the mechanism was carried to the danger position by a spring

The Scottish Forth and Clyde Ship Canal—When the British Admiralty established a naval dockyard at Rosyth, just above the big cantilever bridge across the Firth of Forth, it was urged that if a hostile fleet attacked and brought down the big bridge, the wreckage would obstruct the channel and shut any warships that were at the dockyard away from the North Sea. The advantage of a canal in affording two exits to the sea has given new life to the agitation for the construction of a canal from the Forth to the Clyde. The government has decided however that while such a canal would have a certain strategic value, this would not be sufficient to warrant any large expenditure by the government upon such a proposition.

The World's Largest Power Project.—The State Engineer of the State of Oregon, John H Lewis, has submitted a project for developing 300,000 continuous electric horse-power at Big Eddy, a point three miles above the Dalles on the Columbia River At this location the river runs through a narrow gorge which could be closed by a dam only 300 feet long, and 180 feet above its foundations, and the construction of a canal 300 feet wide, 20 feet deep and a mile and a half in length The head of water is 73 feet at low water and 42 feet at high water and the mean flow of the river throughout the year is 235,000 cubic feet per second The hydro-electric units would be each of 32,000 horse-power The total cost of the scheme would be about $23,000,000.

Electric Traction on British Railroads.—The electrification of the Brighton Company's suburban railways, London, has given excellent results in the economy and the number of passengers carried Comparing steam and electric traction, the number of trains in and out of Victoria Station in one day has risen from 496 to 739 At London Bridge the number has risen from 663 per day to 901 The number of passengers carried on the South London line since electrification has increased over four and one half millions each year over that carried during the last year of steam operation The cost of maintenance of the overhead equipment has worked out at about $107 per mile per annum, and the other conditions of maintenance are stated to be equally satisfactory

Engineering Activity in Argentina.—Attention is directed to the many large engineering schemes which are about to be put through in Argentina and the opportunities which are open for competition by American engineering firms Thus the municipality of Bahia Blanca is asking for estimates for a drainage scheme to cost $1,500,000 A new water supply and sewerage scheme is to be undertaken in the capital which will cost over $20,000,000. An important electric light and power plant will probably, according to the *Engineer* of London, be the outcome of the arrangements now being concluded between the governments of Argentina and Brazil for utilizing the Iguazu waterfalls, which afford sufficient water-power to supply the two states and also the republic of Uruguay with light and fire "probably for a hundred years to come."

Electricity

Electric Power in Contracting Work.—In contracting work in which power pumps, ventilating fans, wood and metal-working tools, air compressors, hoists, concrete mixers, etc, are used, the electric motor has been advantageously employed. The flexibility and versatility of this form of power have especially commended it for the temporary applications characteristic of contracting work A Scotch contracting concern having a piece of reservoir work on hand recently made use of electric power by installing its own gas engine and suction-gas producer generating plant During eighteen months' operation this isolated plant—comprising a 40-kilowatt generator belted to the gas engine, supplying various motors on the work and an installation of electric lights—consumed only 55 tons of anthracite coal

Metallo-chromes.—The electrolysis of lead salts produces peroxide of lead at the anode, and if deposited in films of varying thickness on polished plates beautiful color effects are obtained Gassiot's process involved the electrolysis of lead acetate and an anode of a highly polished steel plate This was laid on the bottom of a basin and covered with a cardboard perforated or cut out in some design On this was placed a copper cathode and a current from two or three cells run for ten or twenty minutes The film of lead peroxide on the anode or steel plate displayed the most exquisite tints of the rainbow, due to the light reflected through the film from the polished steel beneath The tints vary in reflected and transmitted light and are best seen at a window when a sheet of white paper is inclined over the plate.

Sparkless Bell System for Mines.—Telephone apparatus is likely to be dangerous in mines where fire damp occurs, not from any sparking in the microphone, as this appears to be harmless, but from the electric bells which are needed for the telephones. While it is true that some types of electric bell are brought out which are inclosed in gas-proof boxes so that the sparks cannot cause an explosion, it appears that in practice it is a very difficult matter to keep the gas from entering A European inventor, C Feder, now designs an electric bell system so as to be entirely free from sparks, as he uses no moving contacts. For the current, he makes use of a special magneto, fixing the armature and rotating the permanent magnets about it, and thus the armature has no commutator or other moving contacts, but the wires come directly off the coils. No sparks can therefore occur For the electric bell he uses a polarized armature attracted by an alternating current magnet, this working on the line current which the magneto supplies, and no sparks are given

Wireless Telegraphy in Russian East Asia.—At the end of December, 1911, the Russian Postal Department ordered three wireless stations for the northeastern district of Asia. Each station was to consist of two steel towers 250 feet high, with antennae and counterpoises, two kerosene motor sets of 24 horse-power each, coupled to 15-kilowatt, 500-cycle, alternate-current generators, a transmitter of 7.5 kilowatts capacity and receiving an auxiliary apparatus. The three stations are now completed and have been taken over by the Postal Department, which has opened them up to public service They are located respectively at Ochotsk Nayachan, and Novomarilnsk. Ochotsk, situated about 1 200 miles from Vladivostok, is a small town of three hundred inhabitants on the western coast of the Ochotsk Sea. Nayachan, which is about 1,700 miles from Vladivostok, is in an entirely uninhabited tract at the north coast of the same sea, while Novomarinsk, at about 2,200 miles from Vladivostok, is a fishing hamlet on the north coast of the Behring Sea on the mouth of the River Anadyr Nayachan and Novomarinsk are touched twice a year by the mail steamers of the Voluntary Fleet.

Horizontal Antenna.—Kiebitz finds that wireless waves can be received with surprisingly good results by using an antenna made up of wires stretched along at a short distance from the ground, mounting the receiving devices at the center of the antenna. For instance, upon a large flat area near Belzig he stretched several wires between pairs of posts at about 3 feet from the ground. However a combination is made by stretching one antenna from north to south, then a second from east to west so as to cross the first one at right angles and in the middle He also ran a third antenna across the middle point and directed NE and SW, that is at angles of 45 degrees. This latter antenna was about 1,000 feet long and lay in the direction of the Schönberg station (40 miles off), and also in the direction of the Eiffel tower, 500 miles away, and the German post of Swinemunde (140 miles) In this way he was able to pick up these two German posts, as well as the Norddeich post, 250 miles distant. Signals could be heard very well from the Eiffel tower, and he concludes that an antenna of this length is equivalent to a vertical one of 40 feet height. Poldhu was also heard, and he could receive from Clifden and Glace Bay by using a 4,000-foot wire 3 feet from the ground.

Automobile

Paris Forbids the Muffler Cut-out.—Following the example of other foreign cities, Paris at length has seen the light, and henceforth the use of muffler cut-outs in the Fair city will bring swift retribution in the form of the law M Lepine, the Chief of Police, has just issued the edict making their use a misdemeanor punishable by fine or imprisonment.

A Telescopic Spoke for Spring Wheels.—In patent No 1,050,197 Alois Zimprich of Oberndorf-Purgstall, Austria, Hungary, presents a wheel in which there is interposed between an outer rim and an inner rim coil springs which are housed within telescopic sections which slide upon each other as the spring yields in operation

A Spring-tire Patent.—Paul F Wobst of Milwaukee, Wis, in patent No 1 051,939 shows a resilient tire in which the tire casing incloses spring bows arranged within the tire casing and fastened to rods which encompass the rim, suitable brackets being employed in securing the several parts so that the casing distending spring bows will have their resilience increased

Two Automobile-tire Designs.—Fred B Carlisle of Malden, Mass, has secured two design patents, No 43 453 and No 43,454, for tires in which the first patent has formations resembling the links of a chain extending transversely across its rim and in close proximity while the second patent has representations of linked chains extending around the circumference of its rim, the construction in both instances producing a non-skid surface

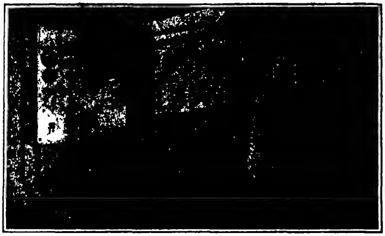
Where Germany Lags Behind Despite the fact that Germany is pressing ahead in the manufacture of motor cars, as evidenced by the fact that two of the largest companies recently have declared dividends of 25 and 27 per cent, respectively, she is still far behind in the number of cars per capita judging by England and France In England, statistics reveal that there is one motor vehicle for every 240 persons, as against one for every 441 in France and one for every 927 in Germany This state of affairs generally is credited to the comparatively high taxation imposed on self-propelled vehicles in the Fatherland

A Policeman's Auto Lock—It is reported that a Washington city policeman profiting by his experience in connection with stolen automobiles, has invented a lock for automobiles for application in the ignition circuit in such manner as to form a part of such circuit. The improved device is said to comprise a rotary electrical switch with which is combined a mechanical locking device which may be adjusted so that it will not interfere with the operation of the switch and which in addition to opening the switch lock may, by means of a suitable key form a part of the electrical circuit and the insertion of any key other than the proper one, will not permit the operation of the lock.

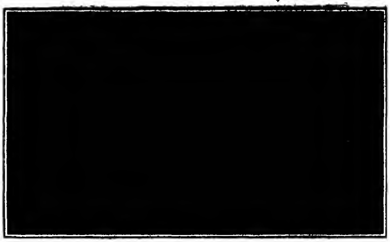
Will Kerosene be Taxed in England?—With the use of paraffin (kerosene) as a substitute for gasolene increasing British users of heavy commercial vehicles view with alarm renewed threatenings of a tax on paraffin, which up to the present time has been free Already the authorities are "looking into" the matter with a view of suggesting the adoption of some such measure The paraffin question is a difficult one however for even if the users of motor vehicles did not find a small tax obnoxious it would visit a hardship on the poorer classes who depend upon oil entirely for light Consequently it would never do to tax it indiscriminately and there enters a neat little problem in how best to differentiate

Phenomenal Speed of Yesteryear—In these days of phenomenal speed and the pride that goes with it in the perfection of modern motors it is instructive occasionally to examine the records of the years gone by As one concrete example, for instance it is recorded (officially) that as long ago as 1908 a speed of 121 64 miles an hour was attained in England in a match race between a Fiat and a Napier The time was made in one complete circuit of the Brooklands track and it never has been beaten to this day on the Brooklands track or on any other The Brooklands track, be it added, is an oval approximately 2¾ miles in circumference which makes plain that at times the speed of the winning Fiat must have been over 130 miles an hour

The Danger of Mechanical Policemen—An intimate study of the ultimate effects of their own devices very probably would benefit those inventors who seek to alleviate traffic conditions by bringing forth various types of "mechanical policemen" designed automatically to slacken the speed of a vehicle or to create a great rumpus immediately the legal rate of speed is exceeded The inventors lose track of the fact that in a great many cases the salvation of the driver lies in the ability for quick acceleration Often the time required to come to a stop to avoid collision is too short, whereas the catastrophe can be averted in nine cases out of ten by a short, quick burst of speed which for not more than a minute, may push the hand of the speedometer well past the figure that marks the legal rate.



Testing a unit in a motor testing laboratory



Method of testing an engine in the laboratory.

Factory Methods of Testing Automobile Motors

How the Testing Stand or Block is Used

By Stanley Petman, M E

FEW in these days of automobiles know of the elaborate manner in which the engines that drive the cars are tested and tried before the purchaser ever hears of them No engine is considered perfect until it has been run for hours and hours under the watchful eye of an expert mechanic and none is turned out of the testing rooms until it has passed the final inspector's rigid examination, has had its horse-power "pulled" and has been duly tagged and recorded

Naturally lengthy testing of the kind is expensive and there must be a very excellent reason for doing it When an engine comes from the assembling rooms it is rough Though its mechanical features may be well nigh perfect, the engine nevertheless is "rough," it requires "smoothing down" and those last final touches which transform it into a perfectly running machine

Despite the advances in the perfection of automatic machinery, jigs and templets, no two engines are exactly alike There are bound to be slight differences of adjustment some bearings will be smoother than others, some pistons and cylinders fit a little better than others. One engine obviously is the best of the lot and it is in order to bring all the others up to that high standard, or to exceed it if possible that careful and elaborate testing is necessary

In factories where many cars are turned out every year, motors are tested on blocks arranged in rows Generally the rows are scarcely more than a dozen feet apart for space is always at a premium where the reduction of overhead expense means much in the ultimate cost of the finished vehicle The individual test blocks too, are placed closely together with just enough room between them for the workmen to attend to their duties

In all such large factories, efficiency engineering principles play an important part Ignition apparatus, for instance and gasoline and water connections, are fastened directly to the testing block It is necessary merely to drop the motor into place (a small electric crane is used for the purpose) and in a few seconds the gas and water leads and the ignition wires are attached What are known in plumber's parlance as quick detachable connections are generally used for the water and exhaust pipes

All the motors have to be "cranked," of course In order to perform this necessary operation some factory superintendents have hit upon a novel scheme which is the same in all cases except for slight modifications. As the motor testing blocks are placed in rows, with the motors all facing the same way, it is simple enough to lay tracks at the ends of the blocks and to mount a small car upon

A new method of ascertaining power delivered at the rear wheels of a car.

Motor test blocks in a western automobile works.

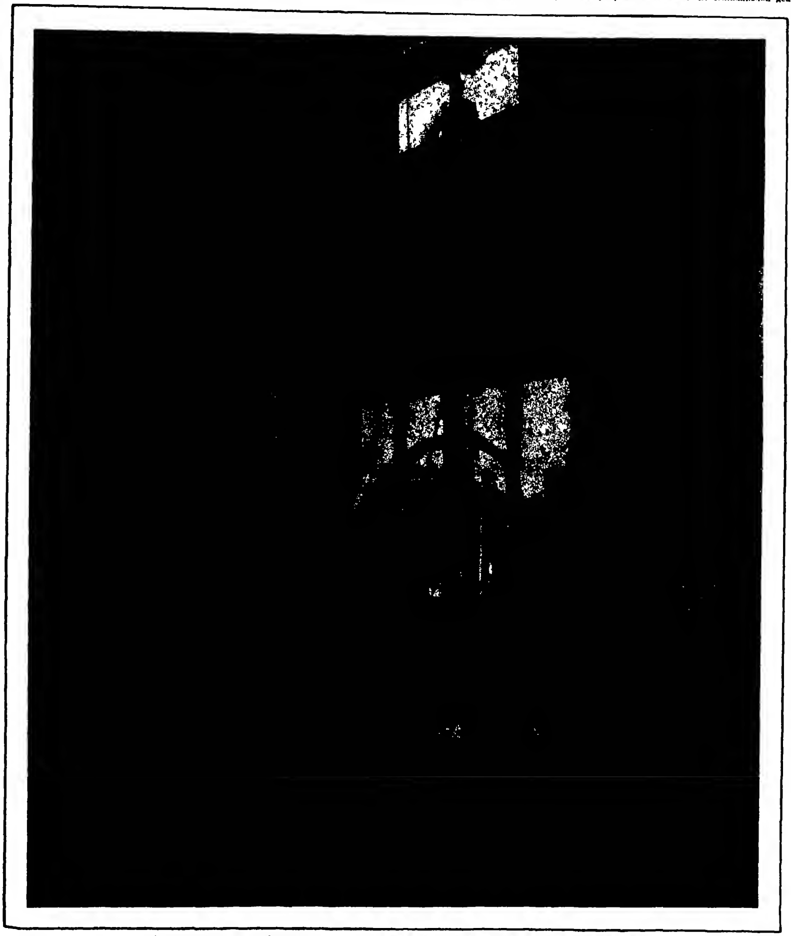
One of seventeen units in a motor testing department.

the tracks. On the car there may be an electric motor supplied either with suitable gearing and a short countershaft with a clutch device to grip the end of the motor crankshaft, or simply with a large pulley and a flat leather belt Current for the electric motor is collected from overhead wires and two short trolley poles. Thus it is a simple matter to connect the electric motor with the gasoline engine in order to start it The system has this advantage The gasoline engine can be "turned over" for an indefinite time while carbureter or ignition adjustments are made Inasmuch as few new motors are more easily cranked than started, it must be conceded that such a system is extremely valuable.

Once the motors are on the blocks and running, it is the practice to permit them to run without load for periods which vary in length from four or five hours, where the factory output is large, and to 12 or 15 hours where the factory output is smaller and greater time can be devoted to the "running in" process. Sometimes motors are driven for several hours by a belt placed over their flywheels before they are placed on the blocks to be run under their own power

When motors are "run in" under their own power "light," they are afterward placed on other blocks and a horse power test taken by any one of several methods. In other cases, where the output is large and the time per motor for testing is more or less limited, it is the practice to couple them directly to electric dynamometers mounted at the back of the testing blocks. In this way the motors are run in under a load, while at the same time it is a comparatively easy matter to ascertain the horse-power they are developing at any moment merely by reference to a central switchboard to which all the dynamometers are connected. When such is the case, it is easy to obtain horse-power readings with the minimum of computation. Each test block is equipped with a revolution counter, and the figuring of the horse-power resolves itself into a simple problem in arithmetic, the voltage and amperage of the generators being known and 746 watts being recognized as the equivalent of one horse-power

If the motors are not tested for horse-power directly on the first testing blocks, but are afterward placed on other blocks in order that the horse-power readings may be taken at different speeds, either an electric dynamometer or a fan dynamometer or a water brake or a Prony brake may be used for the purpose. Computations with either the water brake or the Prony brake are slightly more complicated than those necessary with an electric dynamometer, for which reason the latter is preferred. With a fan dynamometer, however, direct readings may



Factory methods of testing automobile motors. Setting an engine on a stand in the testing room.

be taken from a dial, which method is the simplest of all—simplest because it is known that with the fan vanes set at certain distances from the center of the carrying arms a certain amount of power will be required to drive the fan at certain speeds. Given fan speeds corresponding with given horse-powers, it is merely necessary to convert the fan speed into horse-power directly by means of a table.

For the taking of even more careful tests, there remains the indicator, an instrument which gives a graphic indication of the conditions within the cylinders during the operation of the engine. With such a device it is possible to ascertain just when the motor is operating at its best, when it could be made to operate at greater efficiency, just what the trouble is and how best to remedy any or all faults. Thus, for instance, sluggish opening or closing of the valves will be made apparent by comparing the diagram taken by the indicator with other diagrams known to be theoretically or practically correct. Similarly, incomplete combustion, which is a fault of carburetion or improper scavenging, and also incorrect timing or faulty ignition can be detected readily by means of an indicator diagram. The proper use of such apparatus, particularly on internal combustion motors, requires the greatest of care and considerable experience. Errors are so likely to creep into the results obtained even where the operator is thoroughly qualified to make the tests, that it is rarely used except to "set" a new motor of a new type. Older motors, of course, can be set from the other, reference being made to the timing of the valves and ignition. The indicator also is very valuable in ascertaining the performance of motors which are still in the experimental stage, such as motors in which the stroke to bore ratio is greater than any that has been attempted before. Generally, indicator diagrams are taken in conjunction with the horse-power tests.

In a number of factories, testing on the blocks, supplemented by horse-power tests, is considered insufficient, and motors are given a further test after they have been placed in the chassis. There are several ways in which this may be done. Either the motor may be fastened down on its bed in the chassis and coupled up to an electric dynamometer through the intermediary of the propeller shaft and the transmission gears, or, with the rear wheels jacked up, belts may be placed around them leading to fan dynamometers. In this way not only is the motor tested, but all of the transmission elements are tried out at the same time. A test of this kind is nearly, though not quite, equivalent to a road test.

Still another method is to place the completed chassis, tired, on a platform constructed for the purpose, the rear wheels resting on rollers and the front wheels

resting in chocks shaped to fit them. The rollers upon which the rear wheels rest are geared to an electric dynamometer by means of a chain. Under this method, which provides a rigorous and thorough test for the whole of the transmission mechanism as well as the motor, the operator remains seated in the driver's seat of the car with the volt and ampere meters on a stand set in front of him. Consequently he is enabled to tell at a glance exactly what setting of spark and throttle levers is productive of the best results and under what condition of carburetor adjustment the motor can be induced to generate its maximum power. The readings taken, of course, represent the actual horse power delivered at the rear wheels, and as it is this figure which counts most after all it may be appreciated that the test is thorough. By it transmission inefficiencies may be ferreted out, clutch troubles detected and remedied, the cooling and ignition systems given a careful test in the chassis and, what is even more important, the lubrication of all moving parts except the bearings in the front wheels tested. Finally, brake efficiency can be tested by the very simple expedient of operating the dynamometer as an electric motor drawing current for the purpose from the lighting mains.

In connection with the method of employing electric dynamometers for measuring horse-power it is interesting to note that in several factories arrangements have been made to put the current generated to some useful purpose. In one large factory in the West where production activities are centered in the manufacture of heavy farm tractors, practically all of the current used in running the machinery of the plant is obtained from the dynamometers driven by engines on test. Preparations now are being made to enlarge the testing sheds. One of the principal reasons for the expansion is to permit the use of all current drawn from machines on test. In this way two birds are killed with one stone, so to speak. The motors are thoroughly tested, the current used is employed in reducing the running cost of the factory, and the net result of the lowered overhead charges is reflected in the lower production cost and the lower selling price of the vehicles.

But to get back to engine testing. All such shop testing of course is merely preliminary to the road test. Regardless of what a shop test may show, no man can tell how that machine is going to operate on the road probably in the hands of an inexperienced driver. Consequently they are ultimately mounted in test chassis and sent out over the roads in the hands of a corps of road testers whose instructions are to abuse them. It is their duty to seek out the weak spots either in design or in construction and to report them to the factory superintendent. Naturally, these road testers are experienced men perfectly able to cope with very nearly every kind of trouble that may arise short of actual breakage.

The Lexington Avenue Subway Four-track Tunnel Under the Harlem River

THE construction of the Lexington Avenue four-track subway calls for some important sub-aqueous tunneling below the Harlem River. At this crossing it was necessary to maintain a depth of water above the roof of the tunnel of thirty feet at mean high tide and the tunnel will be constructed to clear this level and will be built with easy grades on each approach.

The method of construction will differ radically from that followed in building the various tunnels beneath the Hudson and the East rivers, where the work was advanced by the use of compressed air and the Great head shield. At the Harlem crossing the structure will consist of four separate steel tubes, embedded in a monolithic mass of concrete and heavily lined with concrete on the inside. When it is completed, its cross section will present the appearance shown in the accompanying drawing, and it will have a total depth of 24 feet 6 inches, and a total width of 78 feet.

The first operation will be to dredge a trench across the bed of the river, which will be 74 feet deep, that is to say, the bottom of the trench will be 34 feet below the original bed of the river, and the width of the trench will be 80 feet. The total length of the steel tubes when they are in place will be 1,080 feet. The tubes, four abreast, will be built in five sections, four of which will be 220 feet long and one, 200 feet. They will be constructed of ⅜ inch steel plates, the contiguous sides of the tubes being flattened in order to reduce the total width of the four as thus assembled. To preserve the tubes in their relative positions and keep them true to form, transverse diaphragms of ½ inch steel will be riveted to them at every 15½ feet of their length. Along each side of the structure, these diaphragms will be bolted to vertical side walls, formed of 4 inch by 12 inch planking, backed by 10-inch by 12 inch vertical timbers, one such timber opposite each steel diaphragm. The wooden sides will be fastened to the structure by bolts which will pass through the 10-inch by 12-inch timbers and through angles riveted to the outer edges of the diaphragms.

Each four tube section will be built on staging erected within one of the adjoining dock slips, the staging consisting of four longitudinal rows of piling finished off with longitudinal caps. When the steelwork of a section is completed, a series of scows, each measuring 14 feet by 80 feet, will be floated in between the piles, at low tide, and as the tide rises, the scows will have sufficient buoyancy to lift the tunnel sections clear of the staging. It should be mentioned that the ends of the tunnel tubes will be temporarily closed by wooden bulkheads, as shown in the illustrations. The section will then be towed out into the stream above the position in which it is to rest on the river bottom, the scows will be scuttled and withdrawn, and the structure will be left floating by its own buoyancy.

Before sinking a section, four buoyancy cylinders are strapped across the ends of the tunnel section, two at each end and water is admitted, first to the tunnel tubes themselves and then to the buoyancy cylinders, until the latter are just awash, at the surface of the water. Two floating derricks will then take hold of the structure, one at each end, the remaining buoyancy will be further reduced, and the whole structure will be lowered away until each end rests on a grillage prepared at the bottom of the trench to receive it.

The top of the grillage platforms upon which the steel structure rests, is about two feet above the bottom of the trench, and the first operation before the buoyancy cylinders are detached is to fill in this space with concrete. The buoyancy cylinders are then completely filled with water and are released from the main structure. It is then necessary only to blow out the central compartment of these cylinders and they come to the surface by their own buoyancy.

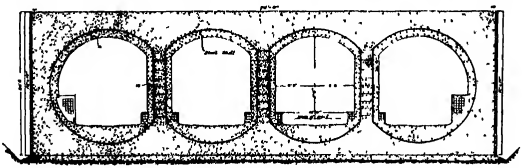
The next operation is to fill with concrete the pockets formed by the diaphragms and the side walls. This is done by means of a big scow of the same general type as that shown on our front illustration, which represents the plan adopted in building a two-track tunnel of the same general character beneath the Detroit River. It should be stated here that the method of constructing these tunnels was devised by Olaf Hoff, C.E., who first applied his method in the successful construction of the Detroit River tunnel above referred to. The scow for use in concreting the Harlem River tunnel will be 25 feet in width by 110 feet in length. At its center will be a two-story structure containing the concrete mixers, and in front of these, erected along the side of the scow, will be five elevator towers of the type shown on our front page engraving. The towers will be so placed that each one, when the scow is in position, will stand immediately over one of the spaces between the adjacent tubes, or between the outside tubes and the side walls above described. Within each tower will be a bucket for hoisting the concrete, and on the outside of each tower will be attached a large pipe which will lead down into the particular pocket which is being concreted up.

The concrete material, broken stone, sand and cement, will be brought to the scow in lighters, loaded into hoppers above the roof of the concrete mixing house, mixed, and then loaded into the buckets in the respective towers. When the buckets are raised to the proper level opposite the funnel shaped tops of the concreting tubes, they will be automatically tripped and will discharge their liquid contents into the tube. The bottom of each tube will descend somewhat below the surface of the liquid concrete that has already been deposited, and the concrete will be of such fluid consistency that it will readily flow and find a fairly uniform level over the whole surface in each pocket. Means are provided for raising the tube as the level of the deposit in concrete rises, and the work goes on uninterruptedly until the whole mass has been completed flush with the top of the diaphragms.

One incidental advantage of this method of concreting is that the concrete sets under a heavy hydraulic pressure, which in the present case ranges from 22 pounds to the square inch at the bottom of the tube to 16 pounds at the top. This heavy pressure serves to thoroughly compact the concrete. We have seen a specimen of the concrete laid by this method in the Detroit River tunnel. It is a core cut from the hardened deposit and polished. It is remarkably compact, and the constituents are well distributed.

The laying and concreting of the cylinders will commence from the center and will be carried toward the ends. When the whole job is completed, the water will be pumped out from the tubes and they will be ready for their interior lining of concrete, which is 12 inches thick on the sides and 16 inches thick on the roof.

The total cost of the tunnel will be $1,620,000, and the contract time for completion, about three years from the present date. The contractors, however, are confident that it will be finished several months before that time.



Cross-section of Harlem River tunnel, Lexington Avenue subway

Sinking a length of tunnel tubes during construction of the Detroit River tunnel.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Control of the Mississippi

To the Editor of the SCIENTIFIC AMERICAN

Some features of the editorial, "The Problem of the Mississippi River," in the SCIENTIFIC AMERICAN of February 15th, should be discussed from all viewpoints, for of course the subject is so important that there cannot be too much light or sincere thought thrown upon it.

In the editorial this statement appears

"As a matter of fact, what takes place is this, when the floods come down, the deep pools are scoured out and the material is deposited on the shoals farther down the river, causing a temporary raising of the bottom at those points As the river falls, the action is reversed, the bars are scoured out and the sand is deposited in the next pool. Careful surveys for several decades show that not only has there been no raising of the river bed, but the cross section has slightly increased "

Please observe

"Col Suter considered it safe to assume that fully 400,000,000 cubic yards of material came out of the Missouri River in twelve months" (P 47, Report by a Select Board of Engineers on Survey of the Mississippi River, Document No 50, 61st Congress, 1st Session, H R.)

"Other observations indicate an outflow of sediment and rolling material of about 36 000,000 cubic yards per year from the Ohio River, about 5,000,000 cubic yards from the Arkansas River, and about 6,000,000 cubic yards per year from the Red River" (The same page)

That is to say, our best authorities indicate 447,000,000 cubic yards of material projected into the lower Mississippi, taking no account of the discharge of material from such streams as the St Francis, Yazoo, White, Hatchie, Obion, Kaskaskia, upper Mississippi, and countless minor tributaries.

The Mississippi discharges into the Gulf of Mexico a possible 300,000,000 cubic yards, which leaves 150,000,000 cubic yards at least to dispose of between the levees annually Light sediment is washed on into the Gulf, behind it follows the vast river of gravel and sand, filling in between the levees as you may have observed, say at what is left of Island No 10, just above New Madrid, and say at Wolf Island and Plumb Point Reach and other points, with diminishing size of particles down to the almost gritless and horrifying slime of the mud bars in the lower river Of course, sand does find its way into the Gulf, say 30,000,000 cubic yards. (P 70 "Levees of the Mississippi," Government Printing Office, 1867)

Compare this 30,000,000 cubic yards of heavy material flowing out the passes with the 213,000,000 cubic yards of sand and gravel coming out of the Missouri alone (p 47, Doc No. 50, above referred to) and it seems clear that the position of the SCIENTIFIC AMERICAN is not according to the facts with regard to the grave question of the cross section between the levees of this day and to come Indeed, in view of the geological history of the Mississippi bottoms, I am not a little surprised to see a position taken that is so clearly and easily demonstrated as untenable Of course, in taking this position, the authorities consulted were mere testimony before sundry and divers committees, and not the original documents containing the figures, at least so it seems to me after carefully considering the deductions, without knowing from what data they were made The Mississippi bottoms are largely alluvial, and the physical conditions have not changed at the behest of the hopes and desires of those who demand the maintenance of the ordinary levee projects in the Mississippi bottoms

Of course, the question of profit is one for mathematicians to answer If the profit of a levee system, essentially and as a matter of theory wrong, is sufficient to make up for the inevitable disasters due to topping the levees at some nearer or farther date in the future, very well, but we should not enter upon a vast expenditure blindly and with ostrich neglect of the fundamental and indisputable fact that the channel inevitably fills Indeed, provision is already being made for this condition, the levees are being thrown up farther and farther apart, because of rising floods. I need not discuss the cause of these apparently increasing floods, nor the probable increase of the finer sediments due to wash of cut-over lands, etc. Neither is it necessary to remind the Mississippi valley students that between the levees now lies some of the most fertile of Mississippi bottom lands, while as the levees recede from the caving banks and the coiling and creeping waters they ever encroach on the better lands, crowding the cotton and other planters farther back into the swamps. That is to say, millions of acres of land between the levees is utterly wasted under the present method of levees.

The minor consideration of the narrow chute between the levees in the lower valley serves to emphasize the comparison to a spillway over a dam, the levees effectually damming the river and ponding the water in the swamps and up the tributaries and main river

The editorial under discussion did not mean, of course, to say that 2,300,000,000 cubic feet per second is the river flow The annual discharge varies from around 11,000,000,000,000 to 30,000,000,000,000 The per second discharge of 1903 reached 1,777,000 cubic feet I am experiencing considerable difficulty in getting recent public documents on the subject, there being apparently no catalogue covering so important a matter as public documents relating to the river I judge however, that it is claimed that a second flow of 2,300,000 cubic feet has been observed Now this is 523,000 cubic feet per second more than the previous record of 1,777,000 Before accepting these figures, it is essential that we know whether soundings were made on the date of the flow, or whether the old cross section for the point of observation was used in estimating the flow The passing of a wave of sand at the time of the measurement would very easily account for the apparent tremendous increase in flow over the previous record I observed in reports of the flood last spring that the coexisting stages on the Ohio and Mississippi apparently did not indicate any such increase, and I tentatively ascribed the crevasse disasters to the filling of the river bed and to the ponding of the flood by increased length of levees preventing the usual overflow at the outlets of various rivers.

I feel certain that the figure of 2,300,000 cubic feet is not accurate Such a figure would, of course, indicate that the levee system is not to blame for the ominous failure last spring, but the figures should not be accepted without a most searching analysis of the figures from which they were made, the point at which they were made, the circumstances under which they were made, by whom, and, as heretofore remarked, whether or not the cross section or cross sections had been greatly changed, due to local or general fill and scour conditions It is interesting to observe that the river flow varies from 97,000 to 1,777,000 cubic feet per second at Warrenton, Miss (Tabulated Results of Discharge Observations, 1905)

I presume that the matter of a settling pond on the Missouri has been considered in connection with the revetting of the lower Mississippi This would stop the river of gravel and sand which menaces the lower river In connection with revetting the river banks, on page 2,476, Report of the Chief of Engineers, U S Army, 1906, is as delicious a bit of humor as ever appeared in a solemn public document Speaking of the works in Louisiana Bend, 522 miles below Cairo, on the right bank, it says

"The total length of the original work was 15,820 feet, of which about 4,000 at the lower end has been destroyed About half the remaining work is protected by a large sand bar!"

There is plenty of frankness and explicit detail in the reports made by the Chief of Engineers, U S A , and a quaint humor is occasionally discernible, especially when the men who know find themselves thwarted by those who don't

Certainly what I have said is not an argument against the proposition to turn the whole Mississippi River project over to the army engineers now digging the Panama Canal Give them full charge and complete freedom, only let us have a thorough understanding and a clear statement of the matter, without compelling the men who know to resort to such perfectly conscious humor as I have quoted in order to indicate the conditions under which they toil and the constant, if locally profitable, folly imposed upon the country by the piecemeal projects now under way I need not add that I am open to conviction with regard to any Mississippi River plan or project, only the plan should coincide with figures and facts already a matter of axiomatic record

Little Falls, N Y RAYMOND S SPEARS

The Co-operation of Capitalists and Inventors

To the Editor of the SCIENTIFIC AMERICAN

In order to have progress we must invent, and in order to invent experimenting is necessary, and to carry on experiments capital must be available

The greatest handicap of the young American inventor to-day is the lack of capital It is a well-known fact that there are few real inventors who have means of promoting their inventions, for the sons of the rich never think about designing or inventing any machine to save time and labor, as their minds are employed in seeking ways to spend what they have for pleasure, however, there are exceptions to this rule A great many persons object to the idea of taking their inventions to men of means for promotion, as many inventors have lost not only their patent rights, but much time and money that was spent in perfecting some useful machine or device by taking it to some unscrupulous party with the object of getting financial aid There are hundreds of useful and much-needed inventions that never get on the market on account of the inventor not being financially able to place them in the channels of trade, so the patent and invention is dropped and the world never gets any benefit therefrom

What I believe to be the most needed in the United States is co-operation between honest capitalists and competent, reliable, and progressive inventors, with thorough patent laws in a systematic way that will protect patentees and inventors to the extent that they will have a fair showing This would do more for the advancement of civilization and progress of our country than all the technical schools combined

Tunnel Hill Ga SAMUEL H KENNEDY

The Neglected Study of Muscular Energy

To the Editor of the SCIENTIFIC AMERICAN

Those of us who give much attention to the contents of newspapers and popular periodicals cannot fail to notice that as time goes on the space given over to popular presentations of scientific subjects tends steadily to increase Not only are we made acquainted with the more easily understandable features of novel inventions and the results of original research but in addition, general outlines of the probable future course of invention and discovery are common

If inquiry were made, as to what special branch of science is of most vital importance to the human race preference would probably be given to the study of the human body

Again if the question were put as to what generalization of modern science has influenced thought in the greatest degree, the law of conservation of energy must surely be mentioned

Having regard to these considerations, is it not remarkable that comparatively little is to be found in print with relation to the conservation of energy and the phenomena of muscular action?

References to the expenditure of energy by the human body are abundant the energy in question being supposed to be derived primarily from food Consideration of the law of conservation of energy would suggest that the body may sometimes receive energy in the form of mechanical work as when a weight is lowered gently, or a clenched hand forcibly opened An elementary knowledge of mechanics must convince us, that muscular action may be divided into two classes namely, the performance of mechanical work by the muscles, and the performance of mechanical work by some outside force against the action of the muscles A little reflection will show that the number of muscular actions falling under the latter classification is not inconsiderable, as might be supposed by some

Whether or no the human body is able to make use of the energy expended upon it, and in what form, would appear to be of vital importance, yet in popular medical literature little reference is to be found to this consideration Possibly the average person would dismiss this subject with a wave of the hand, remarking that the energy must be turned into heat Personally I cannot believe that this conclusion would be well founded F H ATKINSON

London, Ontario

The Prone Position for Aviators

To the Editor of the SCIENTIFIC AMERICAN

A few words about the Prone Position for Aviators. This idea was first put in use by the Wright brothers, who soon gave it up as unsatisfactory Lying in a prone position, one cannot exert as much force upon the control levers or detect the traverse tipping of the machine as well as when sitting upright It would be difficult to design a stream line body that would give the aviator lying in a prone position an unobstructed view Planing down from a high altitude the position would be very uncomfortable, as the aviator would be literally standing on his head But why the prone position, anyway? A well designed stream line body can be made deep enough to permit the aviator to sit up with only his head protruding and still not offer undue resistance to the wind

Brookline Mass. DAVID GASOO

Astronomical "Bulls" Again

To the Editor of the SCIENTIFIC AMERICAN

Your French Academician and his peasant recall a "bull" made by two still more famous men In Act V, Scene I, of Coleridge s translation of Schiller's "Wallenstein" this passage occurs

> "that single glimmering yonder
> Is from Cassiopeia, and therein
> Is Jupiter"

Coleridge has a long footnote on the passage, but finds nothing amiss in it, and if there is any reference anywhere in literature to this particular 'bull,' it has escaped my eye. WILLIAM HARVEY WOODS.

Baltimore, Md.

Detail view of the power house of the Strawberry Valley irrigation project, Utah.

The Great Irrigation Project at Strawberry Valley

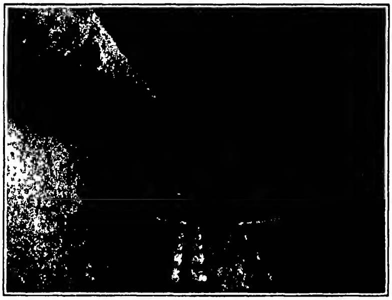
A Remarkable Engineering Task

By Newton Forest

THE Strawberry Valley irrigation project being carried out by the United States Reclamation Service is in many respects one of the most remarkable pieces of engineering in the world. Building a four mile tunnel through a range of mountains and picking a river from one valley and making it flow through this tunnel into another valley is an undertaking even greater than diverting the waters of the mighty river Chagres in the construction of the Panama Canal. But that is precisely what has been done.

The Mormons went into Utah Valley in the early fifties and laid out their farms along the stream that flowed down from the mountains into Utah Lake. For a time their small ditches sufficed for their agricultural needs and they prospered. As the population grew the ditches were enlarged and extended, until every available drop of water was required to meet the demands of the irrigators. In years of scanty precipitation there was shortage in the canals, crop yields were diminished and the late comers frequently lost all. Under these conditions no further development of the valley was possible, yet there were thousands of acres of land just as fertile as any in the valley, which without water were useless. Beyond the Wasatch range of mountains, which rims the valley's eastern border, Strawberry River for centuries has run uselessly by, its water flowing into the Colorado River. The rugged range of snow-capped mountains imposed a seemingly impassable barrier and to divert the flow of the river into the thirsty valley was the gigantic problem solved by the construction of the tunnel, a huge bore nine by ten and a half feet and approaching four miles in length. This tunnel has just been completed and when the sparkling waters rush through it down the sleeping valley a literal transformation in the physical geography of the State of Utah will have been accomplished.

With one exception this underground waterway tunnel is the largest in the world. Many hard engineering problems had to be overcome in planning it and great physical endurance was required of the men who carried out the work. The tunnel pierces the solid rock of one of the highest peaks of the Wasatch range and diverts the water from one drainage basin to another forty five miles away. The country where the work is being done is of a sort to add to the difficulties. For five months a year the construction camp is cut off from the rest of the world on account of the heavy snowfall. However, notwithstanding all the difficulties, a remarkable record of economical as well as rapid construction was made on the tunnel. In a single year more than 5,000 feet were driven and lined with cement. Before construction on the project could begin thousands of square miles of valley and rough mountain country were surveyed and mapped and the tunnel and canal lines marked out. A telephone line some forty miles long, extending from Spanish Fork to both portals of the tunnel, was constructed, as was also a wagon road of the same distance. Down in the foothills a diversion dam was thrown across Spanish Fork River and the waters turned into a power canal three and a half miles long, which dropped them through huge pipes on the big turbines 100 feet below. Power thus generated was transmitted electrically to the tunnel site, where it was used to turn the diamond drills, light the camps and run the heavy machinery. The camps are located a mile and a half above the level of the sea, and the work is carried on day and night in three shifts.



Looking through the four-mile tunnel which will divert a river from one valley to another

Haying on ranch near Mapleton Bench. The alfalfa yield is four tons per acre. Three crops each season.

Beyond the tunnel, in the shadow of the granite peaks, a great reservoir is being constructed. A retaining dam 71 feet high and 490 feet in length of rock, cement and steel is being built for the impounding of the waters of Strawberry River and for the purpose of discharging them through the tunnel into canal systems leading to the arid lands of the valley. The reservoir formed by this big dam will have a capacity of 300,000 acre-feet, or sufficient to cover that many acres a foot deep.

The progress of this work has been full of dramatic and thrilling incidents. The excavation of the tunnel required the constant vigilance of the engineers and the utmost precaution to prevent disasters. Subterranean lakes and springs were opened by the dynamite blasts, and the

inrush of water frequently drove the workers precipitately from the tunnel. Cave-ins threatened injury or death, so that the concrete lining had to follow closely the drills. Notwithstanding all the difficulties confronted the Reclamation Service is completing its work in record time, and it remains now for the landowners in the valley to carry out their obligations, the first one of which will be the sub-division and sale of all individual holdings in excess of 160 acres of the lands irrigated.

The valley to be irrigated is especially interesting because it is the scene of the earliest irrigation by Anglo-Saxons in the West. Settled by Brigham Young and his followers after their march of more than a thousand miles into unknown territory peopled by savages, it is the oldest example of community farming by an English-speaking people in the great West. The attractions of this part of Utah are numerous. It is said to be one of the most beautiful valleys in the world, rivaling the best Switzerland can produce. It has a fine climate, a soil of known fertility and adapted to the growing of a large variety of profitable crops. It is the land of peaches and the big red apple, and promises to be a valley of small farms intensively cultivated, thus insuring a progressive and prosperous community where conditions will be more suburban than rural and where people will delight to dwell.

A Skyrocket Flying Machine

F. RODMAN LAW, known for his foolishly daring feats in the air, surpassed himself in recklessness on the ominous 13th inst.

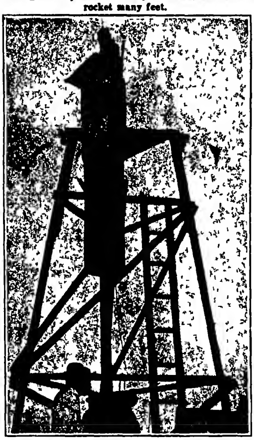
Law attempted to ascend in a giant skyrocket to a height of several thousand feet, tumble out, and descend safely by means of a new safety parachute. This parachute, the invention of A. Leo Stevens, has been used by Law many times for making perilous jumps, such as from the Bankers' Trust Building and the Williamsburg Bridge in New York city and from a biplane at a height of a mile.

The parachute mentioned is made of Japanese silk, and is carried on the back of the aviator like a knapsack. It is claimed that a 6½ pound parachute will carry a 170-pound man safely. The mere act of tumbling out of an aeroplane causes the parachute to open automatically. Law has used it many times, and always without a hitch.

The skyrocket which was to elevate the reckless Law was some 3 feet in diameter and 10 feet in length. It was carried on a heavy timber some 20 feet in length, forming the stick. A seat was provided in its upper end for Law, who sat inside the tube and was covered by the pointed top. The lower half of the skyrocket was constructed of sheet steel and was partially filled with fifty pounds of slow burning powder—enough, it was supposed, to send the rocket with its human load 3,500 feet skyward. Unlike ordinary skyrockets, this giant structure was loaded at the head, so that it was top-heavy. It was placed beside a framing of heavy timber, as shown in one of our pictures.

After Law had taken his seat and put the cap of the rocket in position, the fuse was lighted. It sputtered for some time. Then followed a terrific explosion. The gases, instead of expanding downward as expected, burst the steel shell into many pieces. Law fell like a sack to the ground, a distance of approximately 15 feet. The parachute had no chance to open. Law was badly burned and was rushed to a hospital. He announced his intention of making another trial in the near future. Needless to say, the performance was arranged for the purpose of making a sensational moving picture, and several cameras recorded it. In this respect it was similar to Law's ascent in a balloon above the Hudson River and blowing up of the balloon with dynamite while in midair which he accomplished without mishap several months ago.

The explosion. The gases expanded in every direction, hurling fragments of the rocket many feet.



Law in place in rocket before putting on the cap.

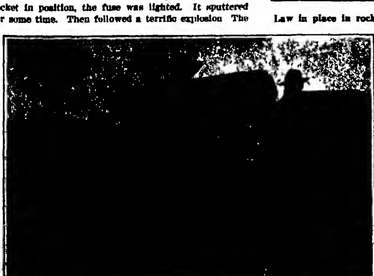
Wilhelm Kress, Aviation Pioneer

WITH the death of Wilhelm Kress, nearly a month ago at Vienna, the oldest aeroplane pioneer passed away. Kress was born in St. Petersburg on July 29th 1836. His father was a manufacturer and the son engaged in piano building. At the age of twenty-eight Kress became interested in the problem of dynamic flight. One day while flying a kite when there was very little breeze the exertion he was put to before the kite would soar caused the young inventor to figure out a way to make it go up of its own accord, wind or no wind. Already in 1864 he had made his first air propeller. The idea came to him to fit propellers to a kite, do away with the string entirely, and become independent of the breeze. His first model brought out in the early '70s, was propelled by a clock spring. Not till 1877 did he make a model which flew successfully. This was propelled by elastic bands and consisted of an aeroplane surface with twin propellers and a rudder for stabilizing purposes. Three years later Kress made public flights with this model. In 1891 at the age of 55 he spent three years listening to lectures in the technical high school in order to perfect himself in mechanics. He had made numerous models which had flown, and now he wanted to produce a practical man-carrying machine. With the backing of the Emperor Franz Joseph he was enabled to order a Daimler motor. It was supposed to weigh under 450 pounds, but when finally delivered it weighed 830 pounds. Nevertheless, Kress mounted this heavy gasoline engine in his aeroplane and tried out his machine. Unlike Maxim, Kress experimented on the water. His machine rose in the air, but capsized owing to improper balance. The inventor got a ducking but emerged unscathed. But he was never able to explain the reason for his upset so that people would believe in him and back him still further. He had spent $25,000 most of it supplied by the Emperor. Without funds he could do nothing, and he was obliged to sit idly by and see others solve the problem of human flight when success was in his grasp.

During the last years of his life Kress was honored as a pioneer. He was an honorary member of the Aero Club of Vienna and of several technical organization. Nevertheless, he died a poor and broken hearted man but not before he had witnessed the coming of the hydro-aeroplane—the machine of which he was in a sense the original inventor.

Such is the fate of many an inventor alas! Clement Ader in France, though he survives Kress, was like him hopelessly "shelved."

The Presidency of the British Association for the meeting in Birmingham (September, 1913), made vacant by the death of Sir William White, has been filled by the appointment of Sir Oliver Lodge.



Several men were needed to carry the heavy rocket.

Carrying the rocket to be set up.

Note his aviator's helmet and the top of the rocket at his feet.

Law lying unconscious at the foot of the frame.

The Heavens in April

Do the Pleiades Shine Through a Haze of Star Dust?

By Henry Norris Russell, Ph D.

A VERY interesting observation has recently been published in one of the Bulletins of the Lowell Observatory which relates to the nebula in the Pleiades.

It has long been known that this conspicuous star cluster was accompanied by faint nebulosity. Only a few of the brighter parts of this are visible to the eye, but photographs of a couple of hours' exposure show that extensive areas are covered by faintly luminous filaments and streaks, which are often nearly parallel and close together over a considerable region. Longer exposures bring out extensive nebulosities extending far beyond the visible limits of the cluster.

These nebulosities are condensed about the brighter stars of the Pleiades—and some of the fainter ones—in such a way that it cannot be doubted that they are really connected with the group. But until the recent work of Mr Slipher at the Lowell Observatory nothing was known of the real nature of these faint clouds of light. Their general appearance on the photographs resembles that of the Great Nebula in Orion which is known to be gaseous and also certain other filamentous nebulæ in the Milky Way whose spectra contain the characteristic bright lines of the gaseous nebulæ. So it would be natural to suppose that, in the Pleiades also the stars are accompanied by wisps of self luminous gas.

But the actual test shows another state of things. Very long exposures are necessary to obtain properly exposed photographs of the spectra of such faint objects. But Mr Slipher's patience was equal to the laborious task of exposing a plate in a suitable spectrograph attached to the 24-inch telescope for twenty-one hours, on three consecutive nights the slit of the apparatus being so arranged that only the light from one of the brightest parts of the nebula about three minutes of arc from the star Merope entered the spectrograph while the light of the bright stars of the cluster was entirely excluded.

On developing his plate Mr Slipher found a distinct spectrum quite different in character from that of any previously known nebula. The spectrum is in the main continuous but is crossed by dark lines which can be identified with certainty as those of hydrogen and helium—the hydrogen lines being much the stronger. As the discoverer puts it this is a true copy of the spectrum of the brighter stars in the Pleiades—so much so indeed that careful tests had to be made to determine whether diffused light from the bright stars may not in some way have got into the spectroscope.

Such tests, made on Sirius, which has no nebulosity near it, showed that the diffused light was certainly not strong enough to produce any visible effect on the plate. It is therefore safe to conclude that the brighter parts of the nebulosity of the Pleiades shine with light which is exactly similar in spectroscopic character to that of the brighter stars of the cluster.

But a spectrum of this sort with dark lines on a continuous background must arise originally from a hot body surrounded by an absorbing atmosphere—in other words from a star, or many stars.

Accepting this there remain two hypotheses to explain the fact. One is that right behind the Pleiades, and probably very far behind there exist great clusters of stars, just similar in spectrum to the Pleiades, but so numerous and so far off that they appear to form a continuous haze in the sky. This is exceedingly improbable and when it is considered that the observed nebulosity tends strongly to group itself about certain stars of the Pleiades group the assumption that innumerable distant stars, far behind, are so arranged in the heavens that as seen from one particular station in the universe they seem to group themselves around these individual stars becomes too absurd to entertain.

The other alternative is to suppose that the nebulosity in the Pleiades consists of opaque matter, perhaps of meteorites or fine dust, which accompanies the stars of the cluster and *shines by their reflected light*. This is free from the difficulties just mentioned, and makes it very natural that the nebulosity should seem brightest near some of the brightest stars. Other bright stars are nearly clear of the nebula, which, on this hypothesis simply means that there is little of the reflecting material near them.

A strong confirmation of this theory is found in the fact (which has long been known) that there are much fewer very faint stars in the region of the Pleiades than, on the average, in equally large regions of the sky. Such stars are undoubtedly for the most part very remote from us, and far behind the Pleiades, and it has been suggested long ago that the nebulæ associated with the group were only partially transparent, and so dimmed the light of the stars behind them, and hid all but the brighter ones. In the light of present knowledge this seems very probable.

One question remains. Can the light which the nebulæ material receives from the Pleiades be strong enough to produce an observable effect, after reflection from scattered particles of matter with wide spaces between them? The answer is in the affirmative for Mr Slipher shows that in the region of the nebula whose spectrum he photographed, the total amount of light received from the stars of the cluster would be fairly comparable to our moonlight—at least to that of the half moon. Now the light even of a half moon illuminates our sky so brightly that it is quite impossible to photograph faint nebulæ like those in the Pleiades. The moonlight simply drowns them out.

The hypothesis that the nebulæ of the Pleiades shine by reflection demands therefore only that their reflecting power shall be considerably less than that of the clear air of the Earth's atmosphere. As these nebulæ are probably hundreds or thousands of millions of miles in thickness, a very small quantity of material per cubic mile would account for all the phenomena.

The writer may add that still one more confirmation of this theory can be found in the observations of more than one astronomer, which show that the brighter stars of the Pleiades are distinctly yellower than the general run of stars of similar spectral type. Now a cloud of *sufficiently fine* particles exerts more absorption on blue light passing through it than it does on red light. This is the case, for example, with light which has passed through our atmosphere, as the color of the setting sun bears ample witness. The light from the Pleiades has to pass through the nebulosity lying between us and them, and, if this is fine-grained enough, it suffices to explain the relatively yellow color of the light which reaches us.

The Heavens.

Our map shows how the skies appear to an observer who looks up at them at the hour indicated below it, for example, 11 P. M. on April 7th. At this hour the Pleiades have set (though two hours earlier they are visible low in the west). Orion, too, is almost gone, but Gemini and Auriga, with Canis Minor to the southward, still make a fine showing in the western sky. Leo and Virgo are conspicuous in the south, with the enormous length of Hydra below, and the small but conspicuous figure of Corvus on its back.

Still lower down we, in our northern latitude, may see a few stars of the Centaur, and observers south of the twenty-fifth parallel of north latitude may see the Southern Cross directly below Corvus on a line drawn through γ Centauri (which last star is just within the limits of our map).

Below θ and η Centauri observers in these same latitudes may see two very bright stars, α and β Centauri. The brighter of the two—and the one farthest away from the Cross—is well known as the nearest star in the heavens.

Scorpio and Ophiuchus are rising in the southeast and east, and Cygnus and Lyra in the northeast. Hercules, Corona and Boötes occupy the eastern sky above these. Cassiopeia and Cepheus are low in the north. Ursa Minor and Draco to the right of the Pole, and Ursa Major almost overhead.

The Planets.

Mercury is morning star all through April, but is south of the Sun and poorly placed for observation. He is at his greatest elongation on the 24th, and rises about 4 20 A. M.

Venus is evening star at the beginning of the month, setting a little after 9 P. M. She is however rapidly approaching conjunction and becomes less and less conspicuous every night. On the 24th she is in inferior conjunction, passing apparently about 6 degrees north of the Sun, and after this time she appears as a morning star, though she will not be easily visible until next month.

Jupiter is morning star in Sagittarius. He is in quadrature with the Sun on the 6th, but being very far south, does not rise till 1 30 A. M.

Saturn is evening star in Taurus, setting about 9 30 P. M. in the middle of the month. Uranus is in Capricornus, and is in quadrature with the Sun on the 28th but being in 19 degrees south declination is observable only for a short time before daybreak.

Neptune is in Gemini observable in the early evening. He is also in quadrature, on the opposite side of the Sun, on the 13th.

The Moon is new at 1 P. M. on the 6th, in her first quarter at 1 A. M. on the 14th, full at 5 P. M. on the 20th, and in her last quarter at 1 A. M. on the 28th. She is nearest us on the 18th and farthest away on the 2nd and 30th. As she sweeps around the sky she passes Mars on the 2nd, Mercury on the 5th, Venus on the 8th, Saturn on the 10th, Neptune on the 13th, Jupiter on the 26th, and Uranus on the 27th.

On Sunday, April 6th, there is a partial eclipse of the Sun, invisible at Washington, but observable as a small partial eclipse in northern California, Oregon, Idaho, and points west and north as far as Alaska. On the coast the eclipse occurs in the morning about 10 A. M. by Pacific time.

Princeton University Observatory

At 11 o'clock Apr 7
At 10½ o'clock Apr 14
At 10 o'clock Apr 22

At 9½ o'clock April 30.

At 9 o'clock May 7
At 8½ o'clock May 15
At 8 o'clock May 22

NIGHT SKY APRIL AND MAY

The New Port of Ceylon

A DEEP-SEA port has recently been laid out at Colombo, Ceylon, and it is to be ranked among the great ports of the world. The work started in 1895, and the area included within the protecting jetties is no less than 685 acres, which is somewhat more than for the port of Dover. A vast area had to be filled in so as to obtain ground for erecting the storehouses, quays, repair basins and coal docks. The jetties which protect the port in an almost continuous belt represent a total of 2 miles length. Good provision for the future is seen in the great size of the repair basin, this having about 700 feet length. The port has a depth corresponding to that of the Suez Canal, but it is planned to deepen it to 36 feet upon three quarters of the area. As to the cost, it is counted that the work involved an expense of $15,000,000, which is not high considering the scope of the enterprise. The present tonnage of the Colombo port is 10,000,000 tons.

"Standardizing" Highway Construction

A Plea for Rational Road Building

By Charles E. Foote

DURING the last half dozen years, in which highway building has progressed from the commonplace to the scientific stage, much has been ascertained about establishing "standards" of construction. Leading civil engineers have written books and delivered scientific addresses before learned societies with a view to the education of those whose business it is to build roads, that they may be able to follow "standards" and to construct first-class highways.

On a six mile stretch of a New York State highway, now under construction, the specifications call for a six inch lower course of field stone, no stone to be more than eight inches in its largest dimension, and the stone to be broken with a sledge until it will roll evenly to a firm mass with a ten ton roller. This foundation course is placed on a thoroughly rolled subgrade. On top of the six inch course of field stone is placed three inches of surfacing material, consisting of broken stone with a bituminous binder.

For the most part of the stretch that type of road will, or ought to, last for years, permanently, if kept properly surfaced. The subgrade is sand and gravel and neither heaves with frost nor breaks in a thaw. The foundation course will settle into the gravelly sand and become as solid as the earth itself. And that kind of soil drains itself.

But at frequent intervals there juts out from the adjacent hills projections of different formations. One may be of hardpan, another of clay, still another of alluvial deposits, and some ledges of loose rock, probably semi-disintegrated limestone. These juttings may be anywhere from fifty to five hundred feet wide where they cross the right of way. Sometimes on account of the narrowness of the valley or the passage of the river close to the hill, it is necessary to excavate the hillside, possibly building a retaining wall to establish such a roadway as is required under the New York law, with fifteen feet of metaling and four and a half feet of shoulder and a three-foot ditch on each side.

While a New York road is taken as an illustration, because of the vast amount of construction under way at the present time, the same principle prevails in nearly every other State where road building is going on. New York has no monopoly of the idea of "standardization" in making roads.

Why does it not occur to the engineers who make the cross-sections and prepare the plans, to except from the general foundation plan those stretches which require different treatment? The veriest tyro in the road building business should know that the standard, as applied to the sand and gravel subgrade, will not be successful when applied to other soils. There must be carefully studied systems of underdrainage, to lower the level of the bench water to a point below the frost line, or back drainage, to prevent seepage of moisture into the road foundation, or such other treatment as the condition may require, even if the stretch of road be not more than two rods in length. Besides, under any such conditions the field stone foundation course should give place to a solid course of evenly broken stone, rolled down, sanded or filled with stone dust, flushed, and rolled some more, so as to make a foundation worthy a good road.

The one thing that may be standardized is the surface. Under present conditions of traffic the standards of to-day are likely to be obsolete to-morrow, even as the waterbound macadam road, the standard for a century or more, has virtually passed out of consideration in new construction.

A road in Madison County, Tennessee. A two-horse team has difficulty in hauling one bale (500 pounds) of cotton. Before improvement

The same road in Madison County, Tennessee. Two horses easily draw twelve bales (6,000 pounds) of cotton. After improvement

Excavating for a side-hill road in New York. On this subgrade will be placed a foundation of six inches of field stone, with a three-inch surface of broken stone with bituminous binder

An Illinois road constructed with a surface of tar macadam.

About the only materials available for road surfacing under present conditions are vitrified brick, broken stone with a binder of bitumen of some sort, and Portland cement concrete. By reason of the limited deposits of clay which will make good road brick and the expense of freights, the use of vitrified brick is confined to limited areas. Wherever it can be used economically brick makes a most excellent road surface. It is dustless, smooth and when properly laid durable. It costs, according to the figures prepared by the National Paving Brick Manufacturers Association, approximately one thousand dollars per mile per foot of width where the expense of grading is normal and the freight not excessive. This cost includes the grade and a five-inch concrete foundation.

Different surfaces made of broken stone and bituminous material are as plentiful as are makers of surfacing specifications. Numerous preparations add variety to the collection. Most of them patented and otherwise make serviceable roads within the limits of their availability.

Concrete of Portland cement with sand and either broken stone or carefully selected gravel as a mineral aggregate is attracting much attention. Wayne County, Michigan, has put down a large mileage of concrete roads during the past four years, and the officials express themselves as entirely pleased and satisfied with the results. Recently a plan of putting on the concrete a surfacing, or mat, of bituminous material mixed with coarse sand or fine gravel has been adopted. This method has become sufficiently recognized so that it has been adopted for a large portion of the California State highway system.

But these are merely the surfacings. The roadbed itself is the road. The surface can be repaired and replaced whenever necessary as part of the upkeep. It can be standardized to-day and the standards readily changed to-morrow if found necessary.

In the same absurd ratio that the soil, climate, etc., must be standardized to enable a standard foundation to be made, must the traffic be standardized to permit surfacing standards to be established. Otherwise all standards must fail.

Ten years ago there were approximately 50,000 automobiles in the United States. To-day, according to the estimates of the manufacturers, there are about one million. Then there were no motor trucks to speak of. Now trucks carrying weights of six or eight or even ten tons are not uncommon.

Ten years ago the horse-drawn traffic on our country roads was limited, practically, by what a two-horse team could pull over the worst places. A ton was considered a big load. Over the improved roads two or three tons are not uncommon. Besides, the light or pleasure driving travel with horses has been multiplied many fold by reason of improvement in the roads.

Therefore, while standards may be made for road surfaces which will meet present travel conditions, what certainty is there that the same standards will be available ten years, five years, or even one year hence? With the stresses on the roadway at least twenty-five times greater than they were ten years ago, what right have we to assume that ten years hence, either by changes and development in vehicular construction, or some new application of power, or the augmentation of traffic in some other direction, the stresses placed on the highways will not be twenty-five times greater than they are now?

Inventions New and Interesting

Simple Patent Law, Patent Office News, Notes on Trademarks

Quick-action Bench Vise

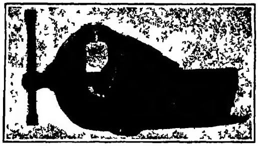
PICTURED in the accompanying engraving is a quick action vise which differs from the ordinary in the fact that it contains no notches teeth or springs. Instead the locking of the jaws is effected by means of tapering surfaces. An adjustment of the jaws is accomplished instantly by simply moving a collar forward which carries the riding jaw with it. The work is first held between the jaws with one hand and the collar is moved forward until the jaws close upon the object after which the jaws are tightened upon the work by a quarter of a turn of the screw. A quarter revolution is all that is necessary whether the jaws be open one half inch or ten inches. The screw consists of a stub threaded into the end of the bar on which the movable jaw is supported. The shoulder of the screw head extends into the overhanging lip of the stationary jaw so that when the screw is turned in the opposite direction it will bear against this lip and force the jaws open. The thumb screw shown in the engraving on the side of the collar is simply a means to prevent the collar from changing its position until it is necessary to open or close the jaws further. The thumb screw is threaded through the side of the collar and extends into the recess in the side of the movable jaw. The supporting bar on which the movable jaw is carried is secured to the tail end of the fixed jaw, and is provided with sufficient lengthwise movement to enable the screw to tighten the jaws upon the work.

New Railway Mail Exchanging Apparatus

THE device here illustrated for the exchange of mail from moving trains was recently installed on the Coast Division, California, of the Southern Pacific Company, for twenty stations north, commencing with Burbank. The apparatus is the invention of a former postmaster at Iola, Idaho who had his attention called years ago to the dangers of throwing out mailbags from rapidly moving trains. The problem was to absorb the shock of the blow which might reach 15 to 20 foot tons on the arm of the standard alongside the track. This he has succeeded in doing with a horn like receiving arm curved to a diameter of about nine feet. The operation is as follows.

On the standard erected at the depot are two curved horns overlapping each other at the point nearest to the railroad track with a delivery arm extending from the standard toward the track, below the horns. On the delivery arm of the standard is hung a ring to which a mail bag is attached. On the car is a track running along the roof with a delivery arm on wheels. The mail clerk in the car hangs the bag by a ring upon this delivery arm. The arm is attached by a chain to a catcher hook which is placed on the outside of the forward end of the door. The action of pushing out a delivery arm along the track places the catcher hook in position and a catch or spring on the delivery arm retains the arm in position over the top of the door spring. As the train approaches the standard, the hook on the car passes through the ring, which is hung on the delivery arm at the standard, and the horn which is pointed toward the direction from which the car is coming, passes through the ring which is suspended from the car outside the door of the car. The hook on the car detaches the ring from the standard. This ring, with the bag attached, passes along the hook and is deposited on the floor inside the car. The horn detaches the ring from the arm which is suspended out of the door of the car, and the ring with the bag attached passes around the horn of the standard to the back where it stops. This action of the horn disengages a catch above the door of the car releasing the delivery arm which automatically returns into the car. As the bag swings around the horns, the horns themselves are turned up and remain at an angle of about forty five degrees, thus making the required clearance along the tracks. The mailman at the depot then detaches his ring from the horn and takes away the bag.

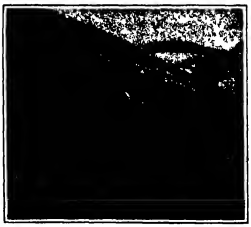
This device was first tested at Belle Vernon, California on the San Pedro Division of the Southern Pacific Company, some two years ago, and experiments of



Quick-action bench vise.

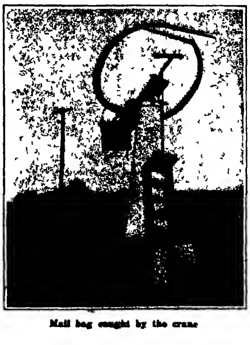
an exhaustive nature were made. In the experiments exchanges were made with bags that were practically empty, as well as with a number of bags at a time, weighing altogether from 150 to 250 pounds. These were delivered to the standard at speeds of from five miles an hour to between 55 and 60. At each exchange bags were taken from the standard into the car as well.

In order to demonstrate the efficiency of this mail exchanging apparatus a pasteboard crate of eggs was placed in a mailbag together with about fifteen pounds of other mail matter. The eggs were delivered from a train moving at the rate of 50 miles an hour, and on the return journey of the train an hour or two later, the same bag was picked up again from the standard while the train was moving at 50 miles an hour. Whether any of the eggs were broken we are not informed. However, we are assured that enough came through uninjured to provide a setting for a hen which hatched out a number of chickens.



Exchanging at forty miles per hour with a 34-inch car door

Hanging the mail bag on the crane.



Mail bag caught by the crane

Inventors and Inventions

PUBLICATIONS of all kinds relating to improvements invariably recognize and praise the efforts of inventors. A Government bulletin issued years ago is quoted as saying, "The discoverer of new products of value to the arts and the inventor of new processes or improved machines, adds to the public wealth, and his right to the product of his brain is now recognized by the laws of all civilized nations." This is the present day view of it, but it was the aim of England in Colonial days, as said by McCulloch in his 'Commercial Dictionary,' "to discourage all attempts to manufacture in the colonies such articles as could be provided for them by England." Of course the purpose of this was to increase the dependence of the Colonies. Senator Platt of Connecticut, probably the best posted legislator as to inventions and patents this country has ever known, said on the floor of the Senate that the passage of the act of 1836 creating the Patent Office marked to his mind the most important epoch in the history of our development. He also said: "It is only when the brain evolves and the cunning hand fashions labor-saving machines that a nation begins to throb with new energy and life and expands with a new growth. At one time a special commissioner was sent here by a foreign nation to gather data in regard to our patent system and in response to a question as to why his people desired a patent system he, it is related, said it was asked 'What is it that makes the United States such a great nation?' And we investigated and we found it was patents, and we will have patents."

Senator Platt before referred to also said and this is interesting in view of propositions from some quarters to increase the Patent Office fees, "A tax upon inventors which provides more than enough to pay the current expenses of the office is simply shameful. It is a tax upon knowledge, a tax on invention, a tax which in itself is as iniquitous and abominable as a tax upon authors or scientists would be."

That distinguished Southerner Hon. John Goode, in a public address, said that inventors "had contributed more to the welfare of their fellows in that period (referring to the last fifty years) than Alexander, Cæsar or Napoleon, and their names would survive when those of the great conquerors has passed into oblivion. In future years the names of great soldiers will shine but dimly beside the names of Fulton, Morse and Henry."

The late Senator Daniel of Virginia once said, "The inventor has redeemed us from the curse of poverty, dissipated the mysteries of humbug and destroyed the monopoly of knowledge." This senator also said, "The Romans of old assigned the highest place in the Elysian fields to him who had improved human life by the invention of arts."

Guard for Overhead Trolley Wires

IN order to prevent the end of a broken, live feed-wire of an overhead trolley system from falling to the ground or from dangling in dangerous proximity to persons or animals, an inventor has devised a guard, consisting of swinging lapped fingers that constitute an emergency support for the feed wire. The fingers are suspended under the feed wire at suitable intervals, and the lapped fingers are held in position by springs so that they will move apart and permit the passage of the trolley pole.

Patent No. 1,048,066 has been granted on this device.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the Scientific American.

Pertaining to Apparel.

SUSPENDER BUCKLE.—M. Kirschner, 146 Lewis St., New York, N Y The advantages of this buckle are a saving of metal, the keeping of the vertical dimension of the buckle particularly the back thereof within the smallest limits, and the manufacture by a minimum number of simple operations, the buckle fulfills the requirements in these respects, and by it the webbing is effectively clamped and the lower stretch formed without a double thickness of webbing at the fastened and thereof

CREASING IRON —H W Pogue Decatur, Ill. An object here is to provide a creasing iron for clothing, made up of two juxtaposed elements, a body member provided with means whereby the side wall thereof may be heated, together with a shoe resiliently held adjacent the heated side wall, the operation being such that the material to be creased is passed between the heated wall and the shoe

BUCKLE.—J C. Rosenkranz, 116 DeVoe St. Brooklyn, N Y The intention in this case is to provide a one piece buckle arranged to permit easy adjustment of the band or strap and to hold the strap securely in adjusted position without the use of tongues, teeth or similar holding or gripping devices.

Pertaining to Aviation.

AIRSHIP —J N Highland, 1048 Hertel Ave Buffalo, N Y Mr Highland's invention has reference to an improvement in airships of the helicopter type, and it comprises a construction which includes preferably supporting means in the form of propeller wheels having extended blades which rotate in opposite directions.

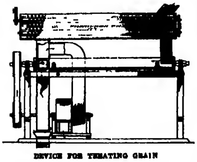
AEROPLANE.—A J A Dufrenoisin 19 Rue des Entrepreneurs, Paris, France. The frame consists of a latticed girder, a portion of which is removed to accommodate the motor together with the passenger seats, the frame being reinforced underneath whereby the girder is strengthened where the lattice work has been removed the surface thereof being rounded, thereby resembling a hull, but not to serve as a boat. This "hull, which is below the front portion of the girder also serves as a means for attaching the suspension and landing devices, the latter are composed of rigid quadrilaterals made up of uprights secured to the 'hull together with skids having wheels attached by a flexible connection along with protecting crutches which form diagonals.

Electrical Devices.

ACCUMULATOR —J Piotrowski and A Kilinski care of L. W Schwenk 292 Bedford Ave Brooklyn, N Y The object of the present invention is the provision of a new and improved accumulator or storage battery arranged to provide a large surface in a comparatively small space and to allow convenient escape of gases and precipitation of sediments.

Of Interest to Farmers.

DEVICE FOR TREATING GRAIN —A J Barbeau St. Henry Ohio. An object here is to provide a device by means of which the outer hard, flinty coat of such grain as wheat, oats, etc, may be removed preparatory to cooking the grain and canning it for use as a



DEVICE FOR TREATING GRAIN

breakfast food The outer hard portion may be removed without crushing the grain, so as to leave the latter in practically the same shape or form as before being treated. Means provide for causing a passage of the grain from one end of the receptacle to the other, and for retarding it in its progress, thereby insuring the complete removal of the outer coat.

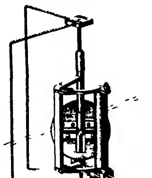
Of General Interest.

WIRE MESH FABRIC —C A Kulenkampff, 59 Sunnyside Ave., Brooklyn, N Y This invention relates to improvements in wire mesh fabric, and has for an object the provision of a structure in which the horizontal and the vertical wires will be so locked together as to prevent any vertical movement of the horizontal wires.

WATER AGITATOR.—T F Preaso, Box 102, Tuckerton, N. J This invention is particularly adapted to agitate the water in the manufacture of artificial ice. In the manufacture, it has been found desirable to agitate the water in order to dissolve the air bubbles therein so as to form a clear transparent ice without air bubbles.

HAND BAG AND SIMILAR ARTICLE.—G H. Gentsel, care of John Mehl & Co. 128 Webster Ave, Jersey City N J The object here is to provide improvements in hand bags and similar articles whereby the frame and body are fastened together by invisible means and in an exceedingly strong and durable manner at the same time retaining the hand sewed appearance of the bag

ELLIPSOGRAPH —W S. Elliott 122 So Cortez St. Prescott, Ariz. This invention relates to drawing instruments for describing an ellipse of any size within the capacity of the



ELLIPSOGRAPH

instrument and it comprises in its construction various novel features permitting of a ready adjustment to vary the size of the ellipse as desired and to promote convenience in manipulating the members

DRAFTSMAN'S TABLE OR STAND —M W Davidson care of University of So. Dak Vermilion, S. D The invention comprises a cabinet upon which a drawing board is adapted to be supported or which may be provided with a superstructure adapted to support a drawing board the cabinet having a side opening which the board, when not in use as such is adapted to close together with means for locking the board in position to close the cabinet and prevent the removal of its contents unbeknown to their owner

HITCHING STRAP —T Schafer, R F D No 5, Olney Ill In the present patent the invention is an improvement in hitching straps, and has for its object the provision of a simple inexpensive device of the character specified, for permanent attachment to the

HITCHING STRAP

harness, and by means of which the draft animal may be firmly secured to a post or the like. The accompanying illustration shows a side view of the halter in place and in a latched position

DOOR AND WINDOW CHECK —J Suren 43 Manhattan Ave Jersey City N J The aim of the present invention is to provide a check arranged to permit of securely locking the door or window against opening from the outside by unauthorized persons, and to allow of partly opening the door or either window sash for ventilating or other purposes.

Hardware and Tools.

DEVICE FOR REMOVING STUCK DRILLS.—F Paul, Hastings on Hudson and C C. Mitchell, Millbrook N Y care of Chas. C. Mitchell 414 Richmond Terrace, New Brighton, S. I N Y This device is designed for removing drills stuck in a drill hole and arranged to permit of conveniently placing the device in position on the drill and surface of the rock or ground adjacent the hole to insure the exertion of the power in the direction of the length of the drill irrespective of the unevenness of the surface

DOOR SPRING —O Katzenberger, Chicago, Ill., care of Lawson Mfg. Co., 215 W Huron St., Chicago, Ill The invention relates more particularly to invisible door springs, and has for an object to provide an improved structure which is of simple strong construction, and which is designed to exert such a strain on a door while it is in a closed position as to prevent wind pressure from opening the same.

Heating and Lighting.

DRY GAS CLEANER.—A. F Plock, 3506 Fifth Ave., Pittsburgh, Pa. The design of this invention is the production of a dry gas cleaner tending to the more economical separation of the dust from the gas, the construction of the cleaner being such that the amount of dust per cubic foot of gas after passing through such cleaner is materially and substantially reduced.

Machines and Mechanical Devices.

CLOTH LAYING MACHINE.—J R. Jups, 372 Manhattan Ave New York, N Y In the present patent the purpose of the invention is the provision of a new and improved cloth laying machine arranged to lay the cloth in any desired number of superimposed layers on a cutting table and to hold the same thereon

SAFETY DEVICE FOR THE CAGES OF LIFTS AND HOISTS —A G Hilling La Salle Ill This automatically operating device will check the descent of a cage of an elevator or hoist in an accidental breaking of the hoisting rope or cable and is constructed so that at the instant of the breaking of the hoisting rope or cable the weight of the car or cage acts to throw into operation the frictional safety device

PULVERIZED COCOA ROASTER —P G Hollstein care of J M Lehman Co, Carlstadt, N J The aim here is to slowly feed the cocoa into the roaster while subjecting the same to a moderate degree of heat which however can be increased or decreased as the nature of the article may require The desired brown coloration of cocoa is attained by slowly passing the same through the roaster forming the subject matter of this application

MACHINE FOR COMPOSING AND CASTING LINES OF TYPE. F Schimmel, 103 Rue du Sergens Blandan Nancy, France This invention provides an arrangement by means of which supplementary matrices each bearing several characters are automatically brought into required position in the line carrier by means of the keyboard of the machine The compositor has only to drop the required matrix into the machine without troubling about the position it may be in and then to strike one of the finger pieces of the keyboard in order to automatically bring the matrix into position

PRINTING PRESS ATTACHMENT —R. R Myers 1045 Jackson Bldg Chicago Ill The object here is to form a simple cheap and easily operated attachment, which may be attached to existing presses with but slight changes, and by means of which the forms may be tightly held and locked on the bed without the use of the usual furniture

BALL AND SOCKET JOINT— R. R. Harrell, care of Dr D L. Harrell 506 Main St Suffolk Va This inventor seeks to provide a novel and effective construction whereby a constant uniform pressure will be automatically secured upon the ball He employs in connection with the ball and the seat or abutment therefor a spring actuated cam mechanism whose action is to press the ball yieldingly to its seat

PEDAL MECHANISM C H Ladew Sa care of Joseph W Birnbaum 421 Columbia St Union Hill N J This inventor provides a mechanism arranged to permit of conveniently folding it inside of the base of the instrument and at the same time closing the pedal opening in the front of the base or to allow of swinging the mechanism outward into extended position and at the same time close the pedal opening so that the base of the casing is closed and the interior of the casing is protected against dust whether the pedal mechanism is in folded or extended position

MACHINE FOR TREATING TANKAGE— C Bertina care of P Burns & Co Ltd Calgary Alberta Canada By the usual method tankage is pressed hydraulically to eliminate the major part of its liquid content and obtain a comparatively dry product It is, however slow and expensive and requires much labor that is hard disagreeable and unhealthful The invention devises an improved substitute consisting of a machine which effects a better result more speedily and with greater economy of labor

VALVE.—J J Meyer, 360 Lenox Ave., New York, N Y The inventor provides a valve which is very simple and durable in construction, not liable easily to get out of order and arranged for use as a stop cock in case it is desired to completely shut off the supply of water from the flushing tank or other similar device

AMALGAMATOR.—S W Merrick, 15 Fairchild Block, Madison Wis. This invention has more particular relation to mining machinery employed where placer mining is practised, or where the gangue is pulverized in suitable mills and delivered to a trough to be subjected to a water bath for the purpose of liberating lighter materials, to be separated by gravity from the contained gold or other precious metal.

BOTTLE CAPPING MACHINE —A Johnson 14 Dunham Place. Brooklyn, N Y An object here is to provide a feature for a hopper whereby the caps to be affixed to the bottles will be fed to their proper position and in the right quantity so that there will be no clogging, and so that there will be a cap in position at each capping operation.

Railways and Their Accessories.

CHILD'S CRIB OR BERTH ATTACHMENT FOR RAILROAD CARS.—L. W Gammeey, Douglas, Ariz. The invention provides a day coach or chair car with an adjustable and folding child's crib or berth which is supported at one side of the car in such manner that it may be conveniently brought into position in front of any one of the seats and lowered to the desired height thereby providing an accommodation for a baby or small child

Pertaining to Vehicles

RESILIENT WHEEL. F I Tioue 188 W 102nd St., Manhattan, N Y N Y This inventor provides a wheel having a rigid rim section and a rigid hub section operatively connected by a resilient structure and provides in a structure rigid spokes converging toward a common center and resilient guide members to maintain the said spokes in line with the center of said hub section

RESILIENT WHEEL. W J Faber care of C C Faber 1821 Brooklyn Ave Brooklyn N Y Among the objects of this invention is to construct a wheel having a pneumatic cushion spaced sufficiently far from the periphery or tread of the wheel to protect it from punctures or severe abrasion and yet provide the usual advantages of the pneumatic cushion now well known to pertain to pneumatic tires

Designs.

DESIGN FOR A VEHICLE BODY —W H Douglas Belleville N J care of Healey & Co 1852 Broadway N Y N Y In his ornamental design for a vehicle body the design represents a side elevation in one figure and a plan view in the second figure Both views are characterized by lines of exceedingly great simplicity and beauty

DESIGN FOR A DOLL Rose O'Neill Wilson care of Otis F Wood 201 Fifth Ave New York N Y In this ornamental design for a doll the figure of the doll is shown in two views, a front elevation and a rear elevation The head is large the body round the legs sturdy small wings extend from the shoulders, and the arms are fully extended

DESIGN FOR A SHOWER BATH BODY —F Bockelman 551 W 174th St New York N Y This ornamental design for a shower bath body is represented in two views, one a front and the other a rear elevation The body is cross shaped and the lines of its form are very graceful

Note. Copies of any of these patents will be furnished by the Scientific American for ten cents each Please state the name of the patentee title of the invention and date of this paper

NEW BOOKS, ETC.

Who's Who in Science International, 1913 Edited by H H Stephenson, London J & A Churchill, 1912 8vo, 572 pp

A book such as this which is intended to catalogue the more scientific workers of all countries, is almost always open to criticism Each reviewer will no doubt find that names have been omitted which in his opinion should have been included It is of course difficult to standardize scientific attainments with such accuracy that all investigators above a certain level will surely be included and all those below as surely excluded Difficult however as the task must be of compiling a work such as this we must commend the editor for his judgment This year's volume is vastly superior to that of last year

Festlaender und Meere im Wechsel der Zeiten Von Wilhelm Boelsche Stuttgart Kosmos Gesellschaft der Naturfreunde Franckh'sche Verlagsbuchhandlung, 1913

Boelsche is one of the best-known writers of popular science in Germany The Kosmos Gesellschaft der Naturfreunde has frequently made use of him in preparing the excellent handbooks of this series. He has a style which is not only graceful but even poetic. The subject of geology, discussed in this volume lends itself admirably to treatment in Boelsche's characteristic way As might be expected of him he has given us a very fascinating account of the titanic processes that resulted in the formation of this earth.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Trucking at Railroad Terminals and Steamship Piers

THERE is no one problem in connection with the use of motor trucks in this city which is of greater importance than that of congested conditions and resultant delays at railroad terminals and steamship piers.

This is a matter which concerns both the user and the manufacturer, together with the latter's agents and one which they should unite in solving.

That some progress has been made was shown by David Beecroft in his recent paper read before the convention of the N. A. A. M.

"Often the system," he said, "of handling freight within the depot, that is from the time it is unloaded off the wagon or motor truck till it is loaded into the freight car causes much delay to the motor truck. In some depots all freight is handled within the building on hand trucks and long delays are caused when motor trucks are unloading by reason of the fact that the freight handlers have to wait for more hand trucks.

"The more enterprising railroad companies are already endeavoring to correct this abuse and have adopted an application of motion study to the method of working the men and the hand trucks. This aims at the men's having a full hand truck load not only from the motor vehicle to the freight car, but also from the freight car back to the motor vehicle. Enormous savings of time have been accomplished in this way.

"Hand in hand with this motion study improvement is that of a new scale of payment for freight handlers based on a stated salary, and in addition a commission on all freight handled above a determined point.

"In this way the freight handler aims at working expeditiously because he profits directly in proportion to the amount of work done.

"To demonstrate that it is possible to hasten the unloading time and also the loading time at terminal depots, one has but to look at the special facilities for handling perishable goods. Often not one quarter of the time is required for handling these goods as compared with that required when handling regular freight. The employment of system will greatly ameliorate the present difficulties.

"To show how firmly the railroad companies are convinced of this we quote from a leading Chicago freight terminal superintendent, who said: 'If motor trucks were used exclusively at six of the big terminals of Chicago, the work would be done in one half the time and at one third the cost. This would mean a saving in Chicago transportation at these six depots of $1,320,000 per year.'"

Disinterested Suggestions on Motor Truck Costs

By H. W. Perry

NOT long ago the head of a manufacturing company wrote for some disinterested information regarding the actual cost of operating and maintaining a three-ton motor truck. He admitted he was skeptical regarding the published tables of costs issued by the truck manufacturers, because he found that they figured gasoline at 12 cents a gallon and drivers' wages at $2.50 a day, whereas, he said, he could buy no gasoline at less than 16 to 18 cents, and the manufacturers of the trucks, or their agents, recommend the hiring of drivers at $3 to $3.50 a day.

Now, it had to be admitted to the inquirer at the start that wholly disinterested information on exact cost of motor trucking was very difficult to get, because the relatively few users of motor trucks who have kept complete records covering a period of several years are exceedingly reluctant to give the figures to any inquirer. They will tell you frankly that it has cost them thousands of dollars to get the information and they do not care to give it to competitors. This fact of itself is *prima facie* evidence that the motor truck is economical, because, if its users were not making or saving money by its use they would hardly have any objection to their competitors' losing money by investing heavily in such equipment.

Tables of Leading Companies.

It was necessary, therefore to refer the inquirer to two leading companies whose motor trucks have been in the American market for the longest time and which have published tables of average costs of motor truck operation based on data gathered from actual services extending over periods up to ten years or more. These tables show the average cost for each size of truck from one ton to ten tons capacity, and include every item of expense connected with the maintenance of motor trucks such as interest, insurance, depreciation, etc.

To be sure these tables give the price of gasoline as 12 cents a gallon which is low at the present time, but not too low for the average price of the fuel bought in quantity during that period. It is also true that the driver's wages are given at from $15 to $22 per week for different sizes of trucks and figured at $2.50 to $3 a day for a three-ton truck which may be a little low for New York city, but not too low an average for the whole country. These tables show the probable cost of gasoline truck service under average normal conditions. There are several sources of similar figures for electric vehicles.

General Horse-truck Rates.

For the man who is unwilling to accept these statements because they are presented by interested agencies, there is another way of arriving at the answer. It is this:

General trucking companies in the large cities make a charge of $7 to $9 a day for hiring a two-horse team and wagon with driver. At less than $8.50 per day they are actually losing money according to the published statement of a firm of public accountants in Boston who have shown from their investigations of many truckmen's books that it costs just $8.54 a day for a team even when it is one of an equipment of 200 head.

However, suppose we take $8.50 a day as a fair average charge for teaming. Such a team will travel fifteen miles in an average day of ten to eleven hours. A fair average load is three tons. Some truckmen claim it is five tons, but one authority, the owner of a team owners' periodical, says it is accepted as a fair average that a fair load capacity for a truck is 1½ times the weight of the team. Draft horses commonly weigh from 1,500 to 2,000 pounds, so that on this basis 6,000 pounds would be a good load. It is certain in any case, that a three-ton motor truck will and does haul as much load as the average two-horse team. The horses stand idle a considerable part of the day during loading and unloading, and the wagon travels empty part of the time. Assume that the team is moving with full load just half of the working day. The work accomplished is the hauling of three tons 7½ miles or 22½ tons one mile. The charge for this is $8.50, which makes the ton mile cost 37¾ cents.

Motor Trucking Rates.

There are trucking companies in many cities that hire out motor trucks or do contract hauling at regular prices by the day, week or month. In New York one motor delivery company charges $13.50 a day for a 3½ ton electric truck which covers an average of 30 miles in a 10-hour day. Figured on the same basis of traveling with full load 50 per cent of the day, this gives 52½ ton miles, at an average ton mile cost of 25¾ cents.

Another company hires a gasoline three-ton truck for $20 a day and says the machine will average fifty miles a day. The work done is seventy five ton miles, on the 50 per cent working basis, and at $20 a day this makes the ton mile cost 26 2/3 cents.

In both cases the cost is only about two thirds that of doing the work with horses. These are actual prices and actual mileages as given by companies that make their living at the business. It is not in the least likely that the motor truck man makes a smaller percentage of profit than the teamster—on the contrary, it will be generally conceded that he makes considerably more. Therefore, it needs no further argument to prove that, under suitable conditions, it costs less to do hauling by motor truck than with horses.

Even at a cost of $20 a day, the power vehicle is cheaper than horses, but the truck manufacturers' cost tables previously mentioned show that the average cost of running a 3-ton gasoline truck is approximately $12.25 a day instead of $20. Granting that this is a fact, it brings the ton mile cost down to 16 1/3 cents, or less than half the cost of horse haulage. How much is this result going to be disturbed if we add half a dollar a day to the driver's wage and four or six cents a gallon to the cost of gasoline? As a matter of fact, fuel is one of the least items in motor truck costs.

Only the saving in trucking costs has been touched upon but economy is, after all, not the greatest virtue of the power vehicle. Its speed and endurance make it a great business builder. The ability to make very quick deliveries, often at great distances, regardless of weather conditions and railroad delays, wins and keeps many customers that could not be served at all by a merchant or manufacturer dependent upon teams.

Increasing the Efficiency of a Stage Line

THE possibilities of increasing the efficiency operation of a fleet of motor vehicles are well illustrated in the case of the Fifth Avenue Coach Company of this city as shown by the last official annual report on file at the Public Service Commission. This report covers the year ending June 30th last, and discloses a policy of retrenchment and economy, which greatly reduced operating expenses without apparently affecting the service rendered to the general public.

One of the principal savings came in reducing the number of "idle" miles covered by the motor 'buses in traveling between the garage and their starting points, from 23,000 miles to 5,961 miles. This was accomplished by erecting several garages and stations, so that the 'buses could be kept very near their starting points. An other was in reducing the cost of tires from $67,568.06 to $45,124.51, despite a greater mileage, the cost of tires per 'bus amounting to 3.13 cents, against 4.08 cents for the preceding year.

One of the principal reasons assigned by President Meade for the marked reduction in tire cost was the purchase of tires outright instead of buying tire mileage. Herein is something for users of commercial motor vehicles to ponder over, and especially its application to the vehicles itself. The prevailing tendency to buy motor truck service guarantees instead of buying the motor trucks themselves on the same basis that most manufactured products are sold, does not work out well for either party concerned.

Motor Truck Researches at the Massachusetts Institute of Technology

To the Editor of the SCIENTIFIC AMERICAN:

The letter of the Harroids Motor Car Company commenting on some results abstracted by me from the second report of progress of the Massachusetts Institute of Technology vehicle research furnishes, it seems to me, the best kind of evidence of the need of just such impartial investigation as that which Technology is carrying on, which has no purpose save the determination of the precise truth.

Two comparative tables are prepared by the Harroids writer, one of a Pierce-Arrow truck, giving operating costs, and the other selected from the Technology figures for electrics. Unfortunately the tables do not follow the same form, and it is not easy to determine whether they cover properly the same items. For example, there appears in the Technology table a "sundries," $200, with apparently no corresponding figure in the P A table.

One fault in the attempted comparison is that while the factors for the Technology trucks are all determined and of record, the P A figures have no stated sponsors or pedigree. One is in doubt whether they are stereotyped trade estimates or have really been deduced from observing the costs of a truck—or trucks—but nothing is said concerning the age, condition, nature of work, kind of roads or other modifying and important items.

The prime difficulty, however, is with the Harroids figures of tire cost and repairs. Technology has had under observation many gasoline trucks, the figures for which are published. They will serve in their average for a sort of standard by which the Harroids figures may be judged. Now the costs of tire are claimed for the P A five-ton truck at $0.0611 per mile, while the average of seventeen assorted five-ton gasoline trucks watched for a year at least by Technology is $0.0885. Similarly for repairs, the Harroids figure is $0.025 per mile but the cash that the owners of the seventeen gasoline trucks actually paid out for repairs last year proves to be $0.0865.

Such differences in the fundamentals obviously put any comparison of the figures out of the question until they can be reduced to some mutual standard, and the situation is further complicated by the apparent claim that the life of a P A five-ton motor truck is twenty years.

The final paragraph in the letter, however can hardly be left unchallenged when one becomes aware of the full facts in the Technology investigation. In view of these the expression, 'The electric vehicle makers seem willing to let the matter stand as it is while we are doing our best to get the true figures so more accurate comparisons can be made,' seems a little unfortunate. The "we" is presumably the Harroids Company or possibly the gasoline car makers in general. But the fact is that the first large research for the truth undertaken with adequate means and under the conditions of actual daily work is that which Technology has now under way. The initiative and the greater portion of the funds for its prosecution have come thus far from electrical interests. There has been money from gasoline car makers for special matters, which is gratefully acknowledged, and other funds have been given like that of Edison for special battery research, but the bulk of the support has been furnished by the Edison Electric Illuminating Company of Boston. This organization is seeking the precise facts and has financed the investigation without any assurance of what the results will show. Other endowment by other interests will of course afford results more quickly than is now possible, while the reputation of the Institute guarantees accuracy and impartiality.

JOHN RITCHIE, JR.

A Diesel Locomotive

FOLLOWING closely the successful application of the Diesel and the semi-Diesel-cycle types of heavy oil burning internal combustion motors to the propulsion of ships, a Diesel-engined locomotive of German origin recently passed through a series of highly satisfactory tests operating under ordinary traffic conditions on a Swiss railway. The power plant is a four-cylinder, two-cycle engine capable of developing a maximum of 1,200 horsepower.

The engine is of the "V" type with cylinders set at an angle of 90 degrees, and the crank-shaft is connected directly with the four driving wheels, without the interposition of clutch or reduction gears, by means of side coupling rods. Naturally this construction implies a great torque for starting and for heavy hauling at low speeds. Hence provision is made for "forcing the combustion," that is for continuing the injection of both fuel and air through a greater portion of the stroke than is done under ordinary circumstances when the engine is operating at its normal speed. This forced combustion has the same effect on the Diesel engine as the elimination of the cut-off on the steam engine. The initial pressure is maintained for a longer interval, and naturally the gases are not expanded to the extent that obtains under normal operation. As with the steam engine the efficiency—fuel economy—is greatly reduced, but the available power is greatly increased, which is the object sought.

By way of supplying the demand for extra air when the engine is operating under forced combustion, a separately driven horizontal compressor is mounted forward of the power plant, and is driven by means of an auxiliary two-cylinder Diesel motor. The compressed air is stored in suitable steel tanks, ten in number, provided at the rear of the cab. Between the cylinders of the main engine are the scavenging pumps and the exhaust manifolds which lead to a muffler placed on the roof. Both engines are cooled by means of pump-circulated water, maintained at the proper temperature by means of a radiator situated on the roof to the rear of the engine. The air, water and fuel pumps are all driven directly from the crank shaft as in ordinary Diesel practice. At the rear of the car is a small steam boiler, oil fired, which supplies the steam for heating the coaches in cold weather.

The locomotive which is 54 feet 3 inches in length over the buffers, is provided with two four-wheel pony trucks disposed at either end, with the four large drive wheels in the center. It weighs, with the tanks full and ready to run, about 85 tons. It is fully inclosed and has the appearance of a steel car. Air is admitted for the compressors through channels just under the roof. Inside the car are platforms on either side of the machinery.

Just what the effect of forcing the combustion will have on the durability of the engine is a matter that will not be fully determined for some time to come. It would seem, however, that the continuation of the combustion for a greater or less portion of the stroke according to operating conditions, would subject a great portion of the cylinder walls to the action of the very intense heat that prevails while combustion is in progress, which circumstance would militate against perfect lubrication and cause the engine to assume a temperature that is neither conducive to perfect operation nor to longevity.

Preventing the Key from Turning.—John Keys of Kansas City, Kan., in a patent, No. 1,049,493, shows a locking device wherein a fastener is attached to the frame of the door and has spring lips flaring to form a mouth and a keeper socket back of the mouth and a key is made in sections pivotally connected so that the ward portion of the key may be inserted in the lock and the handle portion may be swung between the spring lips into the socket, thus locking the key.

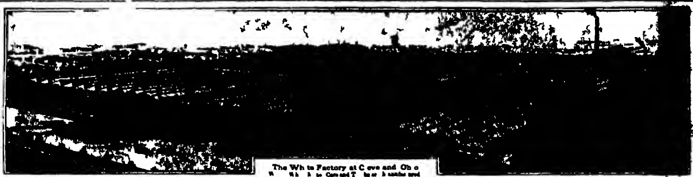
Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents subscriptions, books, etc. This will greatly facilitate answering your questions as in many cases they have to be referred to experts. The full name and address should be given on every sheet No attention will be paid to unsigned queries Full hints to correspondents are printed from time to time and will be mailed on request.

(12762) D G S asks Will you please give information in regard to the weight of the earth or globe? Is it or is it not heavier now than when first completed? A The earth is heavier now than it was at the first by the weight of the meteors which strike it from time to time. Some of these are very small and others weigh considerable. The one brought from Greenland by Admiral Peary weighs some forty tons It is now in the American Museum in New York city The earth, however is so heavy that these additions to it do not affect it to any appreciable degree. 2. The ocean is the reservoir of all the rivers and small streams and it is salt water In returning back to the heads of all the streams, why does it not bring the salty taste with it? A The salt of the ocean is not evaporated, but remains in the ocean water The water which evaporates and goes back in clouds to be dropped as rain on the mountains is fresh water only You can prove this to yourself by dissolving some salt in water and letting it stand in the open air As the water evaporates, the water tastes stronger of salt until it can hold no more salt. Then crystals of salt appear in the dish. Finally when the water has all disappeared you will find all the salt in crystals on the dish.

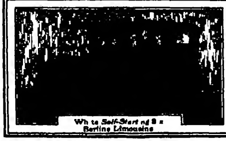
(12763) I J P asks In a lecture on The Great Pyramid of Egypt it was stated that it was built true to the meridian in its day May I ask your Notes and Queries 1 If a shift in earth's axis what direction rate and cause? A The change of the earth's axis which the lecturer spoke of does not refer to a change of the axis in the earth itself which would change the latitude of places but to a change of the direction of the axis in space which causes a motion of the axis of the earth like that of a spinning top This motion is called the precession of the equinoxes, and is explained in all astronomies. See Young's Manual of Astronomy price $2.50 postpaid 2 How much does the pyramid vary from the present meridian and the time this variation would require? A At the time of the building of the Great Pyramid the brightest star in Draco was the North Pole Star and the entrance passage of that pyramid was directed toward that star It is now many degrees from it. It will require 26 000 years for one revolution of the pole of the equator around the pole of the ecliptic. Then the same star will be the pole star again. 3 Are the lines, proportions, facing of stones in the Great Pyramid more accurate than modern engineering works? A We do not suppose that any more mechanical skill was possessed by the builders of the pyramids than engineers possess nowadays They did their work well. The pyramid is well placed north and south east and west There are those who believe that the pyramid can teach us all measures and weights, the size of the bushel and other measures, the length of the year the precession of the equinoxes, and much besides See Piazzi Smyth's great work in two volumes on "Our Inheritance in the Great Pyramid

(12764) F A S. writes In your issue of February 1st P S F mentioned the presence of many angle worms on a crust of snow Now, to your January issue (page 17) there is a short notice of M Thoulet's explanation of how large pebbles are carried by winds Might we not adopt his theory to the case in hand? Might we not say with him that we must accept the idea of fixation around the worms frogs, toads, and snakes (I have witnessed the presence after a heavy rain of at least four little snakes in Chicago's house-yards, whose being there at all could be explained only by the supposition that they were carried there by the rain and wind) of an envelope of air or water vapor? The density of the transported mass of combined solid and fluid matter would then be that of the worms etc. and would be sensibly lighter with respect to its volume. This spheroid would be borne by the wind much like a stiff card sailing through the air A. We have no theory to defend as to the manner in which these particular worms came to be where they were found. Probably they came from the earth underneath. But it is possible in some of the cases of small animals appearing after a severe whirling storm has passed over that they have been taken up by the whirling air and carried long distances. The reference you make to the SCIENTIFIC AMERICAN of January 4th, 1913, page 17, is in point. Waldo, Elementary Meteorology," page 248 gives the velocities which will take up articles of various weights. Some of these are heavier than angle worms, and the wind velocities are lower than are frequently encountered. It is clearly possible that such instances as you cite may be due to ascending whirls of air, or to storms whose axis is nearly horizontal. Such a storm could empty a puddle of water, tadpoles, etc., and sweep them off to drop them many miles from their former home. It is possible, but not so unlikely that this cause should only be invoked when the related facts justify it. One correspondent has taken us severely to task in this matter, but we are not ready to yield the possibility of these occurrences in some instances.



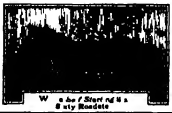
The White Factory at Cleveland, Ohio

White Self-Starting Six Sixty Touring Car



White Self-Starting Six Berline Limousine

White Five Ton Truck

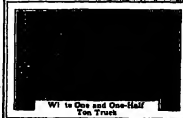


White Self-Starting Six Sixty Roadster

White Three Ton Truck

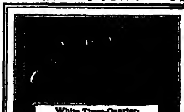
The greatest variety of motor vehicles produced by any company in the world is a White achievement, the result of more than fifty years of practical manufacturing experience, and during all these years the name of White has been the guarantee of absolute responsibility and excellence of production.

White Self-Starting Forty Coupe



White One and One-Half Ton Truck

White Self-Starting Forty Touring Car



White Three-Quarter-Ton Truck

THE WHITE COMPANY
CLEVELAND

White Self-Starting Thirty Touring Car

White Five Ton Power Dumping Truck

White Ambulance

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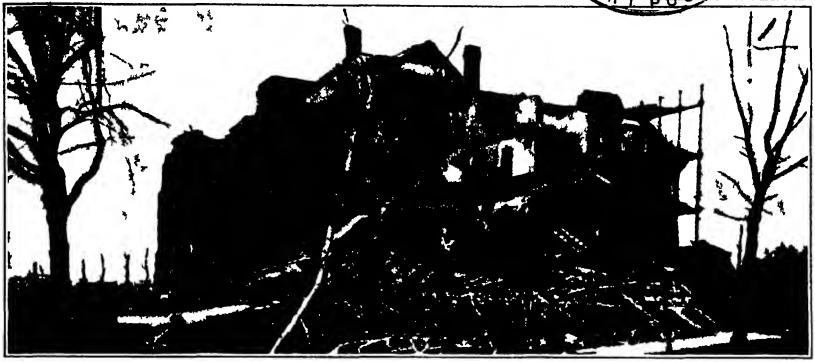

The Sacred Heart Convent in Omaha after the tornado passed

Scene in a thickly populated Omaha district

THE HAVOC WROUGHT BY THE GREAT STORM IN OMAHA.—[See page 315]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement.

Harnessing Nature?

AS WE go to press with an issue of the SCIENTIFIC AMERICAN devoted to the subject "harnessing nature," the country is being overwhelmed by telegraphic reports of appalling losses of life and property which prove how limited, after all, is our boasted control of the primal forces of nature—should they make a sudden and more than average display of their latent powers.

Broadly speaking, the history of the human race may be defined as a story of the ceaseless struggle of man to control the natural forces by which he is surrounded and turn them to useful account by making them the ministers of his comfort, profit and pleasure. In the earlier ages of history these agencies were regarded as hostile and hurtful; and superstition readily clothed the winds and waves, the mighty rivers, the storm cloud and the raging storm with ideas of sinister and cruel malevolence. It took the growth of knowledge, the accumulation of experience and the exploration of the thoughtful mind reasoning from this to that, to gradually open the eyes of man to the fact that the forces of nature, when judiciously cajoled and brought into subjection, might be transformed from supposed avenging deities into helpful servants, the limit of whose contributions to man's happiness and prosperity was measured only by the degree of his intelligence, industry and opportunity.

In spite of the very impressive record made by some of the ancient races—the peoples of Babylonia, Egypt and, later, of Greece and Rome—it must be admitted that the actual conquest of nature—or "harnessing of nature" if the term be preferred—has occurred in the nineteenth and twentieth centuries, the age of steam and steel and electricity. Our giant steamships drive their way the biggest of them—across the oceans, quite regardless of the stress of wind and weather. Our railroad trains speed on their appointed schedules across plain and valley, over mighty water courses, and through the very heart of the mountains, carrying their priceless freight of millions of people and tens of millions of products, with a regularity that fails to astonish only because it is so thoroughly familiar. We live, or do business, in towerlike buildings which we have raised daringly high upon a thousand feet into the heavens where the towering fabric meets the buffeting of the hurricane, not only secure, but practically without a tremor from flagstaff base to foundation. We have shut the once devastating floods securely within their mountain recesses, and we let them run down to the thirsty plains when we choose, and in just such volume as we will. We have joined in wedlock the devastating powers of the floods with the once terrifying fire and might of the thunder cloud, and out of this union have been born those wonderful hydro-electric works which are furnishing light, power and heat to the millions of our towns and cities.

We boast that we have thus harnessed nature to our uses. Yet it is true, and the thoughtful among us well understand that nature has become our beast of burden not by compulsion, but rather by cheerful submission. Now and again she bestirs herself, and, as if to put us in mind of the fact that, if she will she is master, not servant—in some hour of ugly temper, she smites us with the full force of her hidden potentialities. Let her activities become only a certain per cent greater than their normal, and disaster, often terrible disaster, sweeps over the very people whom she seemed so faithfully and submissively to serve. Nature has but to turn herself over, in her long geological sleep, for a little easier adjustment and a San Francisco is thrown down in widespread ruin. Over night, the rains which fill our power producing reservoirs and give the necessary depth for commerce to our rivers, have but to shed something more than their usual supply of moisture, and by the morning cities and villages are overwhelmed by the score, the loss of life is numbered by the thousand, and the destruction of property by millions in dollars.

Judged from the standpoint of science and engineering, although there is much to make us feel extremely discouraged, there is nothing in the recent disasters to make us despair. When these terrific floods have been thoroughly investigated and the causes of the failure to hold them in leash have been ascertained, we shall have learned how to safeguard by better methods of control and more secure construction against a repetition of such a wholesale flooding of fruitful lands and populous cities. Indeed, it is likely that some day in the far future and sooner than most of us are just now able to believe, we shall find out how adequately to control the rivers and keep them within their banks, and build reservoirs of such capacity and stability as will hold back the flood waters until the menace has passed by.

In the presence of such a tornado as has recently swept through the Middle West, we must confess to a feeling of absolute helplessness. Much can be done, it is true, in the way of special construction to mitigate the devastation of a tornado, though it is questionable if even building massively in stone and concrete would suffice in the presence of such an appalling fury as recently swept over the ill fated city of Omaha.

The Society for Electrical Development

WHATEVER may have been the sins of the gigantic trust, even its enemies were willing to admit that it was usually efficient, largely because its administration was centralized. But a single department purchased the cargoes and train loads of raw material which it converted into manufactured products, a single advertising staff prepared its selling announcements and bought space in magazines, a single board of directors guided its commercial destinies, in a word harmony and co-operation were substituted for discord and strife.

Now that the Government has decided through its courts that many combinations of manufacturing enterprises, however economical and efficient they may be, are detrimental to the best interests of the country, how is it possible to apply the lessons taught by the trust without incurring the displeasure of the Attorney General of the United States? An answer is to be found in the Society for Electrical Development, formed for the sole purpose of introducing electricity more widely and of eliminating the useless friction which has marked the development of the central station industry in this country. Although electrical goods and electrical energy to the value of two billion dollars a year are sold in this country, the market for electricity has only been skirted and never really penetrated. There have been conflicting interests and conflicting policies, with the result that of all marketable commodities—and electrical energy is as much a commodity as oil or sugar—electricity is not sold on an efficient and businesslike basis.

All this the Society for Electrical Development intends to change. Central stations, architects, contractors, electrical manufacturers, the host of industries dealing in electricity or dependent upon electrical energy, are to unite in popularizing electrical service. There are about ten million buildings in this country in which electricity could be used to profit. Yet only one in five is wired for service. If the public can be taught that electricity is not a luxury, if the central stations can be brought to the view that the small consumer's business in the aggregate is as lucrative and even more so than that of the occasional large consumer, if the thousand and one interests that have been warring in the past can join forces in the effort to expand the electrical business of this country, we may indeed look forward to that "electrical age," which has existed hitherto only in the pages of the sensational newspaper.

Fortunately the men responsible for the creation of the Society for Electrical Development have long been identified with the electrical industry in this country. Mr. Henry L. Doherty is the president. Associated with him are Mr. Wakeman and Mr. Philip S. Dodd, both thoroughly familiar with the business needs of central stations and manufacturers of electrical goods. Thus competently guided, the enterprise should infuse a new spirit of co-operation into the business of selling electricity and electrical goods. If it succeeds, as it gives every promise of doing, the experiment will probably be repeated in other industries, for it will [illegible] the retention of the trust's efficiency in selling, without any attempt to control the market.

Small Internal Combustion Engines on Land and Water

IN SEVERAL ways, the designers of motor car engines would seem to be lagging behind their nautical brothers, and the increasing use of kerosene fuel in small marine engines indicates one very important step forward that is not shared alike by both. So far, very little indeed has been done by the automobile engineer in solving this difficult problem, whereas the number of marine internal combustion engines utilizing the cheaper fuel is steadily increasing. As a matter of cold fact, the manner in which manufacturers of such engines have turned to kerosene for a solution of the fuel problem and the great number of them that have succeeded in employing it instead of gasoline (with gratifying results, be it added) constitutes one of the real features of the year.

Manifestly, it is no easy matter to convert an engine constructed for gasoline consumption, to operate on kerosene, or on some of the still heavier distillates, as not a few of them do. Merely altering the carbureter and providing means for applying heat to assist vaporization will not suffice, for, although almost any gasoline engine can be made to run on kerosene after it has become sufficiently heated, it cannot be made to run efficiently on the heavier fuel. Efficient operation requires other and more extensive alterations which virtually necessitate a complete re-casting of designs. Up to the present time, marine engine manufacturers have done very well, considering the comparatively short space of time that has been seriously devoted to experiment. That there still remains room for improvement is evident in the universal necessity for employing gasoline as an alternative for the inevitable heat, for starting purposes. In other words, the kerosene engine that will start "all cold" on kerosene, as infallibly as will the gasoline engine on gasoline, has yet to be evolved. But problems apparently more hopeless than this have been solved in the past.

But though the makers of small marine engines undoubtedly are ahead of their landsman brothers in the use of kerosene, they are behind them in several other matters, prominent among which is the inclosure of such parts as the valve mechanism. Marine engines of the high-speed type are steadily becoming more like the typical automobile motor, as witness the marked tendency toward the block construction of cylinders and the extension of crankcases to include the clutch and reverse gear, thus making of the whole power plant virtually a single unit. Despite this fact, however, designers apparently have overlooked the desirability of inclosing the valve parts, as it is done almost without single exception in automobile motors.

The accomplishment is simple in itself, requiring as it does merely the addition of a couple of light metallic plates, and its advantages in reducing noise and decreasing wear by excluding dirt and permitting more plentiful lubrication must more than offset the low initial cost. On the score of decreased noise alone, the addition of such protection plates would appeal, for as every one knows, the valve mechanism is the hardest of all to silence, and there are few things more abhorred by the average motor boatist than the incessant clicking and hammering of the valve tappets.

Thanks to the ingenuity of the makers of such apparatus, high tension magneto ignition is used to a much greater extent now than it has been used in the past, which fact also marks favorable imitation of the automobile motor. The undoubted simplicity of the high tension magneto, as compared with the complexity inherent to the batteries and coils and timers of other systems, has led to the practical elimination of its one previous fault—its susceptibility to the influence of moisture. And now that this difficulty has been overcome, the increasing use of such instruments presages their still more widespread adoption in the not far distant future.

Thus, though the makers of small marine internal combustion motors have made notable strides in the past twelvemonth there is still apparent an apathy toward the engine starting devices which have become so popular for automobile work, and this despite the fact that almost invariably the marine motor is much more difficult to start than is the automobile motor. Obviously, the lower temperature at which it operates normally, and the greater dimensions of the cylinders as a rule are responsible for the greater effort required to "turn it over." That the tendency toward the use of engine starters exists, however, is made plain by their adoption by several prominent manufacturers. And it is not too much to expect that ere another year has passed, marine engine builders will have turned quite readily to such labor-saving safety devices.

Electricity

Energy Consumption in Electric Weldings.—In a discussion in a recent paper on "Resistance Welding" the remarkably small amount of energy required to weld iron wire was brought out. A weld between a pair of 5/32-inch rods takes 20 watt-minutes, which means that 3,000 welds of this kind could be made with the expenditure of one kilowatt hour of electrical energy. However, the amount of energy rapidly increases with the diameter of the rods welded, 5/16-inch rods requiring 2,000 amperes, about nine times as much energy as rods one half that diameter. This increase is due to the increased contact area and also to the rapid cooling through the jaws holding the rods.

The Telephone Equipment of Capt. Scott's Expedition.—An English paper gives an interesting illustrated account of the telephone service that was provided to connect five stations of the British Antarctic Expedition, that is, the living quarters with the four instrument and observing stations. In order to save weight, a matter of such prime importance in the transportation of supplies by polar explorers, the line wire employed was bare hard drawn aluminium. About 75 miles of this wire was carried and the lines connecting the stations were metallic circuits of this bare wire laid about six feet apart on the dry snow which, as is well known, is an excellent insulator. The low temperature precluded the employment of individual batteries at the stations, and a 24-volt "common battery" was used.

Working Cables and Land Line Without Re-transmission.—A new and very simple system of submarine cable working, the invention of a British telegraph engineer, is announced. By reversing the current for each successive signal, the distinctness of the signals is so increased that the siphon recorder, hitherto the receiving instrument *par excellence* for cable working, bids fair to be eliminated. By the new system two successive dots, for example, are signaled by two currents of opposite polarity. It is stated that the ordinary Morse code can be used, and a land line can be joined up with a cable and a message sent by an ordinary telegraph key. Although it does not appear that the speed of signaling is increased by the new method the elimination of re-transmission at the junctions of land lines with cables (under certain conditions which will doubtless appear when the invention has been tried out) is in itself an important improvement in telegraph engineering.

A New Electric Tanning Process, invented by the Swedish scientist Dr. A. Groth and applied on a practical scale in an English works, is attracting much attention, and it is stated that one of the prominent electrical firms is soon to take it up for commercial use. With this method, the hides are put in special vats along with metal conductors, so as to carry out an electrolytic action, and this will tan the hides in much less time than usual, for instance, six weeks as compared to several months. Leather of better quality is produced in this way, and the method gives a perfect and solid tanning. The details of the method are not as yet made public. Various electrical devices in the shape of regulators and indicators, also safety apparatus for over-current, make the process almost an automatic one, and in the present trial plant at Kidderminster two persons are all that is needed to take care of the whole. Should anything go wrong in one of the vats, electric bell or lamp signals give warning at once. The plant keeps running day and night.

Remote Control of Light and Power Circuits.—Turning on and off the electric lights connected to a distant service circuit has been a problem that has hitherto been met in three ways: by sending a man to manually switch on the lights in the evening and switch them off again in the morning, by clockwork switching devices set to operate at a pre-determined hour, and by utilizing a prepayment meter to open the circuit when a determined amount of energy shall have been consumed. A new method of remote control of lighting and power circuits, whereby such circuits may be closed at any time from the central station (as for example to cover the contingency of a sudden fog, and varying hours of darkness) has been devised, utilizing a special current superposed on the main lighting current whether the latter is alternating or direct. The new system is particularly adapted to the control of street lighting circuits. In the application of this method to alternating current service a "ripple" or alternating current of higher frequency than the actual frequency of the service current is sent out over the mains for an instant, actuating a local switch-operating relay permanently connected to the mains but designed to be sensitive only to the "ripple" frequency. In the application to direct current service a condenser included in the relay circuit acts to prevent consumption of energy in the relay except during the moment of passage of the alternating current ripple which traverses the condenser in operating the relay.

Science

Captain Scott's Journal.—According to the London *Times* Lady Scott has telegraphed from New Zealand that her husband's journal is in her possession, "excellent and complete." The whole will be published shortly in book form, and parts will appear in an English magazine.

Peary at the International Geographical Congress.—Rear Admiral Robert E. Peary recently sailed for Naples, on his way to Rome where he is to attend the Tenth International Geographical Congress, which opens on April 10th and the meeting of the International Polar Commission which will follow it. Rear-Admiral Peary will represent the United States officially.

The Philatelic Library of the late Lord Crawford, the most comprehensive collection of books and pamphlets on postage-stamp collecting that has ever been brought together, or is ever likely to be, has become, by his bequest, the property of the British nation, and will doubtless be placed in the British Museum. Mr. Bacon's catalogue of it, recently published, is a large quarto volume of over 450 double-column pages, and its compilation extended over several years.

The Brilliancy of Venus in the evening sky during the early months of this year has led to the usual crop of wild rumors as to what the "strange light" could be. In England it has been mistaken for a German military airship, while the newspapers of southwestern Russia have been reporting nightly visits from an Austrian spy in an aeroplane. It may be recalled that, many years ago, a section of the New York public took the same planet to be an illuminated balloon sent up by Mr. Edison from Menlo Park in the course of some mysterious experiments.

The Term "Gonfire" is applied in Haiti to mysterious acoustic phenomena, probably of subterranean origin, and evidently belonging to the class of sounds known as "brontidi" or "brontides" (see SCIENTIFIC AMERICAN, January 18, 1913, p. 66) reported from various parts of the world. They seem, however, to be much more varied in character than the typical brontides of Italy, Belgium, etc. Sometimes they resemble the boom of cannon, but again are described as deep rumblings, howlings, a rushing sound, as of wind, a deafening crash, "as if a mountain of glass were shattered," and so on. They have been known in Haiti from the times of Moreau de St. Méry and the other early historians of the country. St. Martial Observatory, at Port au Prince, has undertaken a systematic investigation of this phenomenon by means of a *questionnaire* addressed to numerous residents of the island, thus following the example of Van den Broeck in Belgium, and Alippi in Italy.

The Failure of the "Electric Niagaras" or overgrown lightning-rods, recently erected in several parts of France in the belief that they would avert hailstorms by drawing the electricity from the clouds, is reported in emphatic terms by a writer in the *Journal* of the National Society of Horticulture of France, M. A. Laforest (who, however, advocates the equally illusory expedient of 'hail-shooting'). Several severe hailstorms occurred in Paris shortly *after* a great "Niagara" had been installed on the Eiffel Tower. (See SCIENTIFIC AMERICAN June 29th, 1912, p. 548.) On June 19th, 1912 hail fell in great quantities at the very foot of the tower and over an extensive area adjoining. The use of these devices began some eleven years ago in the department of Vienne, and it has been repeatedly claimed that they have completely exempted that part of France from hailstorms ever since they were installed. This claim was, however, investigated by M. Turpain, in 1911, and found to be without foundation. Fifty-two "Niagaras" had been erected in various parts of France up to last October.

Scientific Results of the War in the Balkans.—In the *Bulletin of the American Geographical Society* Leon Dominian calls attention to the rich field of investigation that will be opened up by the passing out of Ottoman control of a large section of the Balkan peninsula. Nearly every square mile of the territory in question needs mapping, and it is besides a practically virgin field for geological, ethnological and historical research. To judge from the cartographical work heretofore done in Bulgaria by the Military Cartographical Institute, at Sofia, we may expect excellent map-work in whatever territory that country may acquire from Turkey. Whatever may be the merits of the quarrel between Turkey and the allies, it is notorious that science and exploration do not flourish under the Crescent, whereas the other Balkan states are at least in sympathy with modern ideals in these fields, so that the outcome of the war, up to date, is fortunate from a scientific standpoint. Just to mention one point of contrast: Bulgaria, Servia and Greece all possess official meteorological services, with networks of stations whose observations furnish the material for compiling climatic statistics of those countries. Turkey has nothing of the sort, and what little information we have of her climate has not been gathered by Turks.

Aeronautics

The International Commission for Scientific Aeronautics (which ought to be called the International Aerological Commission) will hold its next triennial meeting in London, in 1915.

Bomb for Use with Aeroplanes.—Hiram Stevens Maxim, of London, England, assignor to Vickers, Ltd., Westminster, England, has secured a patent, No. 1,052,000, for a bomb for use with flying machines, which bomb has a charge of high explosive, a detonating charge and a pole which is adapted to move relatively to the bomb when the latter is liberated and to bring the detonating charge into position to fire the main charge when the extremity of the pole strikes the ground, an object or a target.

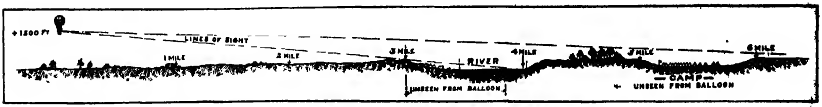
Aerological Station in the Heart of Africa.—The German government, which has already done so much more than any other government in the world for upper-air research, is now planning a permanent aerological station on Victoria Nyanza. It was over this lake, in the year 1908, that a German expedition sent up the first sounding-balloon that ever reached the isothermal layer in equatorial regions, and observed at an altitude of 12 miles, the lowest temperature ever recorded in the atmosphere, viz., 119 degrees below zero Fahrenheit.

An Erroneous "Record" in Ballooning.—In August, 1909, much interest was aroused by the statement published in the London *Times* that two Italian aeronauts, Lieut. Mina and Signor Piacenza, had ascended from Turin in the balloon 'Albatross' to an altitude of 38,715 feet, exceeding by more than 3,000 feet the altitude attained in the famous ascent of Assman and Süring in 1901, which was a world's record. According to a note published in *Nature* this story was something very like a *canard*, as the aeronauts had no proper means of measuring their height, and have since published a revised estimate reducing the reported altitude to 30,800 feet.

Aeronautical Surveys.—The idea of carrying out surveys in the Sahara and elsewhere with the aid of airships and aeroplanes has often been suggested, and it seems likely that many blanks on our maps, where ordinary surveying methods are difficult or impossible, will ultimately be filled up in this manner. A German writer calls attention to the fact that the first demonstration of the feasibility of such undertakings was furnished by the Italian military aeronauts during the recent war with Turkey. A large tract of country around the city of Tripoli was mapped from overhead. The data thus obtained enabled the general staff to construct a series of charts on a scale of 1:40,000.

Strain on Monoplane Wings.—In a recent number of *Flight* Mr. Griffith Brewer takes up the subject of the collapse of monoplane wings. Calling attention to the fact that about a year ago Bleriot reported to the French government that monoplanes were liable to collapse in the air, not only by the breaking of the stays under the wings, but also by the breaking of the supports over the wings, Mr. Brewer inquires into the cause of the structural collapse to which monoplanes seem to be peculiarly liable. Because the wings of monoplanes project like arms from the sides of the frame, he agrees that it is easier to twist the outer ends of the wings than the shoulder portions. "Without changing the path of flight of the machine," Mr. Brewer states, "the speed of travel may increase and this causes the center of pressure to travel backward, thus tending to turn the wings over forward, owing to the pressure below the front portion decreasing while the pressure increases below the rear portion. The effect of this change in the center of pressure is a progressive twist from the shoulders of the wings outward, the left wing twisting like a right hand corkscrew and the right wing twisting like a left hand corkscrew."

Aeroplane Trips Between Nice and Monte Carlo.—The Trans-aerian company is organizing a daily service of aeroplane trips over sea between Nice and Monte Carlo on the Mediterranean coast. Hydro-aeroplanes are to be used, and they will fly along at a short distance off shore during the trip. For greater safety, a motor launch will accompany the flyer, although it is now recognized that there is little danger in an over-water trip on a hydro-aeroplane. This appears to be the first instance of the regular use of the hydro-aeroplane, and the results will be watched with interest. The trip from Nice to Monte Carlo costs $50 and the round trip $60. A ten-minute flight near the well known Promenade at Nice will cost $40 additional, with the same rate for a flight over the bay at Monte Carlo. The company has already installed a station at this latter port, and the hangars are located at Monaco on the south quay, along with a slip for putting the aeroplanes afloat. Passengers can thus be easily taken on board. At Nice a motor launch takes passengers from the Promenade to the embarking point. During the trip, the flyers will alight at the midway point of Beaulieu where a special wharf of iron construction is put up, and a motor boat takes the passengers from here to the landing place of the aeroplane, or the reverse. Astra hydro-aeroplanes will be used.



The scout in the air does not always discover the location of hostile troops.

Achievements of Military Aircraft

Lessons Taught by the European Maneuvers and by the Tripolitan and Balkan Campaigns

By Major H Bannerman-Phillips

LET us consider in a general way the advantages and disadvantages inherent in aerial as distinct from ordinary reconnaissance on the ground To begin with the observer's power of traveling freely in any direction weather permitting regardless of terrestrial obstacles and of placing himself directly above any object so that his line of sight is at right angles with the earth's surface gives him a considerable advantage The enemy's dispositions would seem at first sight to be inevitably laid bare to him and this is true though with certain reservations The observer, in order to be safe from the fire of troops on the ground, must remain at a fairly high altitude and if in an aeroplane, must travel very swiftly Therefore his line of observation passes through a number of layers of the atmosphere the state of which affects the possibilities of reconnaissance Hence his view of terrestrial objects is liable at times to be blurred and indistinct Secondly the enemy will be on the lookout for him and in the daytime he can hardly hope to escape observation himself and if he is covered by clouds from view of the enemy the objects he is reconnoitering will also be hidden from him Now for purposes of military reconnaissance exactitude of observation is essential therefore the scout must have a good view Yet while under certain weather conditions a man may be able to find his way about a country and recognize his whereabouts, he may not be able to make exact observations of the enemy's dispositions and may send in incorrect information In any case the aerial observer requires special training and aptitude more so than a scout at the ground level

The Difficulties of Reconnoitering in the Air

In observing the dispositions of troops in the field, under normal conditions of the atmosphere and from such a height as to be reasonably (though not completely) safe from terrestrial marksmen say 3000 feet, the radius of observation from moving aircraft may extend to four or five miles from a point vertically below the observer Beyond this height it becomes difficult to distinguish various objects on the ground surface Troops on the march can be seen and their numbers estimated from the road-space occupied, and the size of camps and their arrangements can be noted Artillery in action are an easily distinguishable mark and so are cavalry on the move and transport columns of all kinds. Massed infantry in the open are fairly distinctly seen and peculiarities of uniform may help the observer but infantry in khaki are difficult to distinguish when in extended order advancing or retiring through stubble or ploughed land and not always clearly seen on grass. Infantry columns halted during a march and sitting or lying down at either side of a road are not easily made out In order to get any idea of trenches outpost arrangements, and the methods of occupation of bridges and fords, the observer will have to descend within the danger zone of fire Further it is a common error to suppose that everything is clearly visible from aircraft in mid air For instance at 1500

Army transport wagons at Mustapha Pasha as they appeared to the air scout

The battlefield at Mustapha Pasha viewed from an aeroplane.

War trains at Mustapha Pasha railway station, a very busy transport center as it appeared during the war from a military flying machine.

feet up, one cannot get a view into the bottom of a valley the direction of which crosses the line of sight at a distance of say three miles if the slope down to the valley is steeper than 6 degrees. Motionless troops are hard to see even on flat ground, and the amount of concealment afforded by trees to troops underneath them (or where the trees are lofty, and come between them and the aerial observer, for some considerable distance behind them) is far greater than would be supposed Movement will often betray the presence of any enemy who would have escaped notice if he had remained motionless, and, as often happened during the Boer war, clouds of dust will betray the movements of troops, especially horsemen, at very long distances. In clear weather bodies of men such as single squadrons, battalions and batteries, can be seen, when closed up at seven to eight miles with ordinary binoculars. Fieldworks, if their color and outline do not blend with the surrounding features of the country may be seen at four or five miles, but are not readily distinguishable To tell "dummy" trenches from real ones is difficult sometimes impossible Railways which run parallel to the line of vision are readily made out, embankments and cuttings being especially visible but a railway running at right angles is not always seen unless attention is directed to it by a train in movement or the smoke and steam of a locomotive Rivers, canals, and water in the form of ponds and lakes stand out clearly and so do bridges, but from considerable heights the smaller details of a landscape are very difficult to make sure of. Hop-fields in England with the poles and wires concealed by the summer's growth of hops, have been taken for pasture land before now

Hiding from the Man in the Air

The airman's greatest difficulties will come in the future when the art of concealment of the movement of troops, and their disguise by various methods, may be expected to reach a high pitch of perfection

The British army maneuvers in East Anglia in 1912 were remarkable for the success of the reconnaissances effected from air-craft of both the gas-supported and heavier-than-air types, but there was one notorious failure which proved the exception to the rule. The Fourth (Blue) Division succeeded in performing a march from near Cambridge to Mildenhall, about sixteen miles, entirely unseen and unreported by the Red air-scouts, yet these latter were watched by the Blue troops from the ground-level, sailing overhead in various directions. If such an incident were related in the history of a campaign it would seem incredible, but it actually occurred nevertheless. This result was secured by simple expedients—so simple in fact that after the event they were dubbed "puerile" by at least one military critic, but their success in this case certainly justified their use. In the first place the troops started their march during the night and covered as much ground as possible before day-break. Secondly, during daytime they kept in small detachments and took every advantage of the shelter of the trees, and when halted,

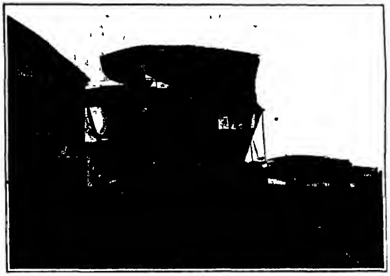
or on being warned by whistle of the coming of an aeroplane, stood, sat or lay close under the hedge-rows at the side of the roads, or under any umbrageous cover which could be found. Thirdly, the white bands on their caps and anything noticeable about their accouterments were covered up and guns and wagons when moving in the open were masked with straw to simulate country carts and farm wagons. Now it was averred after the operations by many critics, that the aircraft throughout maneuvered unrestrainedly as regards aerial opposition and at altitudes so low as to bring them well within reach of the enemy's fire, thus making the whole system of reconnaissance unreal and that the information so readily obtained would never have reached the commanders under actual service conditions, with ball cartridge in the rifles, and the guns firing shrapnel. Therefore, if with these facilities and under favorable atmospheric conditions the 12,000 men and horses of the Fourth (Blue) Division could succeed in escaping the observation of aerial observers at a most critical period of the operations and during a march of some sixteen miles, are we to draw the deduction that aircraft will be able to entirely take the place of cavalry in reconnaissance? This in fine weather, but when the morning mists are impenetrable from above and the clouds so low that air scouts must descend to within reach of their enemies they run a good chance of being "potted" like driven grouse by a hailstorm of lead from marksmen invisible under leafy shelter and able to make good practice at the passing aeroplane, no longer soaring eagle-like in the "blue empyrean," but within easy rifle range; and a dead or captured scout has done bad work for his own side by allowing himself to be made non-effective, and causing the loss of his aircraft.

Lessons Taught by European Maneuvers.

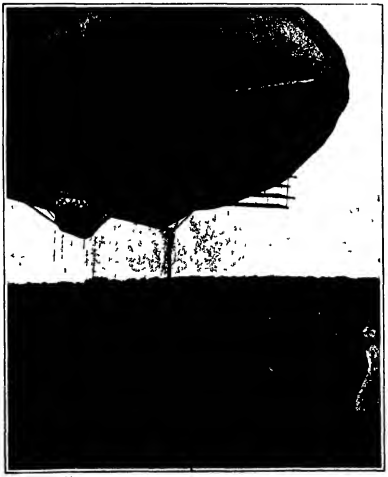
If we turn to the armies of the European continent we find no suggestion whatever of substituting aircraft for cavalry, although a far greater and more systematic use of the former has been made in French and German maneuvers, and by the Italians in Tripoli than in England or America, and the criticisms of spectators with military knowledge and the reports of the umpires alike bear witness to the extended and valuable services rendered—more particularly by aviators in aeroplanes—when the conditions are favorable. In the French army the organization of aerial scouting is superb, according to some of the ablest British and German critics. A French general can reckon upon having any specified region examined by his aeroplane scouts, and the art of observation from mid-air has been reduced to a system as regular as that of cavalry reconnaissance. Yet in spite of this a general and his staff were taken by surprise by a body of the enemy's cavalry at the last maneuvers and captured, though they had aerial scouts at their disposal; they received no warning of the approach of the hostile horsemen.

A French critic of the German maneuvers in 1912, writing for the *Matin* newspaper in September, spoke in the highest terms of the organization of the German airships, and their officers have had ample experience in observation of military details. Yet during the previous year's maneuvers the Red side succeeded on one occasion in deceiving the scouts on board the Blue dirigible "M II" (which was sailing at an altitude of 3,000 to 4,000 feet) as to the whereabouts of their main position. The weather was rather cloudy; a "dummy" position with artistically imitated field works, possibly not very clearly distinguishable under such atmospheric conditions, drew the attention of the aerial observers, who in good faith reported it as the enemy's main position, whereupon the Blue force halted all night before it with a view to attack at dawn according to the best "sealed pattern" tactical methods, only to find in due course that it was a blind, and the real position had been carefully entrenched some miles away.

At the German maneuvers in September, 1912, the impossibility of relying upon aircraft alone for reconnaissance was strikingly illustrated. During the operations about Oschatz-Mügeln both armies entrenched themselves on the night of September 12th, and were facing each other at a distance of a few kilometers anxiously awaiting dawn. At daybreak they met in battle. There was a thick mist until 9 A. M. and no information was obtainable otherwise than by cavalry; neither airships nor aeroplanes could enable the overhead observer to see anything at all, but the mounted scouts were able to get very close to the infantry unobserved. The cavalry, taking advantage of these conditions, made repeated charges against the infantry and their performances served to remind military critics that in spite of modern inventions the sword and lance need not yet be relegated to the museum. At the conclusion of the operations the general staff



Removing a wrecked British biplane from Salisbury Plain



By courtesy of the Sphere

A German military Zeppelin coming to anchor

commenting thereon, laid great stress on the decisive rôle played by the cavalry, and though approving of the work done by the aircraft, pointed out that these latter by no means made cavalry reconnaissance superfluous, since for two days out of five the weather kept both dirigibles and aeroplanes on the ground.

Triumphs of the Air Scout

That air scouts may render invaluable service in the matter of clearing up the "fog of war" goes without saying, not only by procuring information on their own account, but in verifying and confirming or disproving, with a minimum waste of time, reports which have been sent in by other means. Thus, for instance, during the German maneuvers of 1911 they saved the Red side from being deceived by a bogus map, dropped by the Blues, and a dummy position in connection therewith. During the operations about the Tchatalja lines in 1912 in the Turko-Balkan campaign it is said that on one occasion Derkos was reported to have fallen into the hands of the Bulgarians, but an aviator who was sent up to find out about this returned within the hour with an assurance to the contrary.

During the Italian campaign in Tripoli the frequency and regularity of the aviators' ascents and their freedom from mishaps were outstanding features of the service, though airmen were wounded on occasion and such accidents occurred as the stoppage of the motor involving a long glide to earth. Fortunately in the latter case the descent was finished within the shelter of the Italian outpost lines. Thanks to the work of the air scouts in kite balloons, aeroplanes and dirigibles, the Italian generals were regularly informed of the enemy's movements and strength both at close quarters and at a distance, and the country between the coast and the mountains of the Hinterland was carefully explored and its main features noted, these notes enabling corrections to be made in existing maps. This could not possibly have been done by methods of cavalry reconnaissance under the circumstances and would have cost the lives of many men and horses in the attempt. Whether similar results could have been obtained if the Turks had been able to oppose aircraft with aircraft is difficult to say, and on the vexed question of aerial combat, as of practice with specially devised guns against aeroplanes and dirigibles, there is as yet no information available. Even the Turko-Balkan campaign has added so far nothing to our knowledge of these matters. No practice under peace conditions is of any use, since one cannot use aeroplanes or airships proceeding at speed under human guidance as targets like the "running man" on a rifle range, and experiments against towed kites and captive or drifting balloons are quite inconclusive.

Possibilities of the Giant Dirigible

As regards the possibilities of the various types of aircraft under favorable conditions of weather for scouting purposes, we know that the airship has many advantages over the aeroplane. To begin with, its radius of action is enormously wider. The Zeppelin airships now building will, it is understood, be able to travel 60 miles per hour, but even the present "L I" is capable of 50 miles per hour and on October 13th and 14th, 1912, traveled 1,047 miles in 31 hours, including an overland and oversea voyage, experiencing both thick fog and clear weather. Besides a full crew sufficient to work the vessel in watches, a staff of special reconnaissance officers, photographers and gunners, with apparatus for visual signaling, wireless telegraphy (300 miles range and more), search-light, bomb-dropping apparatus and machine guns, it can carry sufficient fuel for a 40 hours' voyage; a margin of 4½ tons lifting capacity (over and above the weight of the fuel) allows for ample supplies of explosives, provisions and water ballast. Such a vessel can stay aloft for several days if the amount of fuel consumed can be reduced by hovering and drifting with favorable winds. It can remain stationary for reconnaissance, photography or bomb-dropping, consequently affording a better platform for these purposes than the aeroplane.

While the aeroplane is of questionable utility for night work, the airship is able to travel as well by night as by day, and it affords greater facilities for navigation by compass or the stars. It is certainly liable to lose gas by day if considerable changes of temperature occur, owing to alternation of sunshine and cloud, but there is no loss by night. In daylight it can remain at 4,000 to 6,000 feet above the earth practically safe from artillery fire and at night it can descend to 1,000 feet and hover over a locality with stopped engines, in order that scouts may employ both ears and eyes in their work of reconnaissance. When it is necessary to keep up a continuous service of aerial protection, the dirigible involves comparatively little strain on the personnel, whether crew or observers, whereas the expenditures of energy and nerve-force and the exposure of pilots, and even to some extent of

(Concluded on page 3[illegible].)

Harnessing Nature

Can the Free Energy of Space be Utilized?

By Waldemar Kaempffert

IN a few centuries the world's coal mines will be exhausted. Whence shall we derive the energy to turn the wheels of industry? By harnessing nature is the answer. Long before we took stock of our fuel supply and found that we must husband what little we have left, scientific dreamers wondered whether natural forces could not in some way be utilized. To be sure, the potential energy stored up in every combustible is a natural force; however artificial our engines may seem, their power is nevertheless ultimately obtained from the sun. But that power is released and applied only by complicated and cumbrous mechanism that wastes many times more energy than it delivers. Why should it not be possible to tap the free energy of space, the energy with which the sun, for example, incessantly bombards us? Can not some engine be devised to transform and make available the apparently inexhaustible supply of energy inherent in every atom of radium? To answer questions such as these with anything like satisfaction is impossible. Yet they are discussed by the most distinguished physicists of the day, and therefore they acquire a dignity with which they might not otherwise be invested. At the fourth annual meeting of the British Science Guild, for example, the whole vast subject of harnessing nature was considered and a committee of seventeen was appointed to report upon it. Among the members of that committee were such distinguished scientific men as Sir William Ramsay, Hon. R. J. Strutt, Prof. Vivian B. Lewes, Sir Charles A. Parsons, Mr. Dugald Clerk, and Dr. Hele Shaw. The committee has not yet handed in its final report, but it has done enough to show how wonderful are the possibilities of engineering when combustibles will no longer be available and along what lines the investigator must work if success is to be attained.

Water Power

The only natural source of free energy that engineers have thus far successfully utilized is water power. How they have gone to work is so old a story that it need not be retold here. Their task was simple. The crudest kind of bladed wheel ground corn centuries ago. The great turbines of Niagara Falls are merely improvements upon it.

A water fall is a ready made solar engine, the only commercial solar engine that man has succeeded in utilizing. No machine has ever been designed or ever will be designed that will surpass the water fall in efficiency. The sun pumps the water of ocean, lake and river on mountain tops, and the force of gravity drops the water again to its original level. The cycle is endless. Because there are no valves, no shafts, no connecting rods, no thermal losses, the efficiency is one hundred per cent. It has been calculated that the total energy of these atmospheric deposits amounts to 100,000,000 horse-power. With the advent of electricity and its introduction into industry part at least of this energy is being used, the sole example of the successful use of nature's free energy.

Putting the Sun to Work.

But why not go directly to the sun? Its radiation has been measured and expressed in engineering units. In his Royal Institution lectures of 1911 Sir J. J. Thomson stated that, shining from a clear sky, the sun sends to the earth energy at the rate of 7,000 horse-power an acre. Moreover, as the temperature of the sun is at least 8,000 deg. Cent., this energy must arrive in a highly available condition; theoretically it ought to be almost wholly convertible into mechanical work. No wonder that the construction of a commercial solar engine has been one of the most fascinating problems that ever engaged the attention of inventors.

Up to within recent years the most elaborate experiments on record were those of Capt. John Ericsson, designer of the famous "Monitor." On a rainless strip eight thousand miles long and one mile wide, extending almost continuously from Africa into Asia and from South America into the United States, solar heat enough is wasted, he figured, to drive 22,000,000 solar engines of one hundred horse-power each nine hours a day.

In endeavoring to utilize a very small part of this truly staggering amount of wasted energy Ericsson worked persistently from 1865 to 1878 and built in that time no less than seven sun engines. He adopted the rather obvious method of concentrating the sun's rays on a boiler when he was driving his engine by steam, and on an air chamber when he employed one of his "caloric" engines. Eventually he succeeded in obtaining about one horse-power for every one hundred square feet of reflecting surface. Finally he came to the conclusion that the scheme was impracticable. "The fact is," he frankly admitted, "that although the heat is obtained for nothing, so extensive, costly and complex is the concentration apparatus that solar steam is many times more costly than steam produced by burning coal."

Since Ericsson's day other attempts have been made along different lines. Readers of the SCIENTIFIC AMERICAN are familiar with the proposals of Mr. Frank Shuman, Prof. Reginald Fessenden, and Messrs. Willsie and J. Boyle, Jr. Because their apparatus has been described in these columns at sufficient length it is unnecessary to dwell upon it again. In all these three solar power plants, the "hot box" of de Saussure, Langley and other pioneer solar physicists is employed. In other words, a film of water is heated in a glass-covered trough. The heat impounded by the trough is sufficient to raise the water to the boiling point, or very near it. Mr. Shuman has designed a low pressure steam engine in which this hot water is flashed into steam. Messrs. Willsie and Boyle employ their hot water to vaporize a liquid, which has a boiling point lower than that of the water, a liquid such as sulphur dioxide. The vapors which are given off from the sulphur dioxide at a pressure of 215 pounds to the square inch drive a specially designed engine and are then returned to be used over again. The water which has given up its heat to the sulphur dioxide is sent through the hot box again to absorb more heat from the sun.

Since the sun does not shine by night even in the desert of Sahara, a storage system must be devised—a piece of apparatus that can be charged with excess power and tapped at will in sunless periods. Compressed air tanks, storage batteries charged by dynamos driven by the solar engine, water pumped into a reservoir by a solar pump and used later to drive a water wheel, have all been proposed. Messrs. Willsie and Boyle store their hot water in a well insulated tank, so that it retains its heat over night and is always hot enough to vaporize sulphur dioxide. Mr. Shuman has also designed an insulated tank or boiler for storing hot water.

Prof. Fessenden, in the solar power scheme described and illustrated in the SCIENTIFIC AMERICAN two years ago, considered it more expedient to pump water into a reservoir and let it drop a considerable height against a water wheel. He, too, heats his water in a thin film under glass, causes the steam thus generated to drive a low pressure pump directly and thus fills his reservoir with water. In the plant illustrated in the SCIENTIFIC AMERICAN he showed a way of lifting Channel water to the top of the Dover Cliffs, so that it would flow back through a pipe and drive a water turbine at the bottom of the cliff. In conjunction with each solar plant a windmill is to be operated, so that, as he explains, "much better all-day and all year efficiency will be obtained because the wind is, as a rule, more effective during cloudy weather and at night time, i. e., when solar radiation is diminished or absent."

If we can extract heat from anything we can perform work. Water can be boiled without fire simply by reducing the pressure of the atmosphere. Since the atmosphere contains a certain amount of heat, why not extract it, as it were, and drive an engine? That is a proposal which Mr. Nikola Tesla has made. The direct utilization of the sun's heat after the manner of Ericsson, Shuman, and others seems to him commercially hopeless, however practicable it may be on an experimental scale. Moreover, he cannot reconcile himself to the idea that the entire manufacturing interests of the world must be transplanted to Arizona, southern California, Egypt, or the Sahara desert when the world's coal supply is exhausted and the solar engine is at last realized. Industry seems to be identified with the temperate zones, where sunshine is intermittent. The periodicity of sunshine, with which all solar engineers must reckon, he finds an insuperable difficulty. Moreover, it seems inept to him to convert the intense heat of the sun into low temperature heat, of which only a small fraction can ever be recovered as mechanical work. In his opinion, the only direct way of converting solar energy into work is to tap the heat units of the atmosphere, heat units available at all times, in fair weather as well as foul, in summer as well as in winter. There is no need to invent storage systems, for the atmosphere is its own storage tank. This is, to be sure, but a thermodynamic dream as yet, but a dream which, however wild it may seem, is nevertheless worthy of at least academic discussion.

The Photo-chemical Power Transformer.

Every living organism is a crude kind of solar engine. We are all dependent on the product of the soil for our existence, and that product in turn represents so much solar energy chemically stored up. A grazing cow is a living engine that converts solar energy into work. The solar energy that has caused grass to grow is turned to practical account whenever she flicks a fly from her back. Prof. V. Coblentz has suggested that perhaps a chemical substance may be discovered, which, when exposed to the sun, is transformed into a stable substance capable of giving up its energy for subsequent consumption, a substance more highly efficient than grass and capable of releasing its energy perhaps in an electrical way.

This idea was further developed in a profound analysis of photo-chemical problems before the recent International Chemical Congress by the distinguished Italian chemist, Prof. Ciamician. An obvious cycle, he suggested, was the use of mineral fertilizers to raise a harvest, which, dried by the sun, could be converted entirely into gaseous fuel, the ammonia being fixed and returned to the soil as fertilizer, together with the ash. He also deemed it possible to produce the things we need directly without the intervention of much factory machinery. If ammonia can be directly obtained from atmospheric nitrogen and hydrogen—the recent technical achievement of a great German chemical manufacturing company—why should it not be possible, he asks, to utilize solar energy in connection with catalytic substances and thus artificially reproduce plant processes on an unprecedented scale? A photochemical laboratory in northern Africa might thus produce immediately useful substances now supplied only after much coal burning, engine-driving and mechanical handling of raw material. A meadow is not a highly efficient transformer of solar energy, but the manner in which it synthesizes the chemical elements stored up in the earth with the aid of sunshine might well be artificially reproduced, and the solar engine itself abandoned except for purely thermodynamic purposes. If a plant can reverse the process of combustion, if it can transform the carbon dioxide of the atmosphere into starch, simultaneously setting free oxygen, why can't man adopt the same principle with success? At all events, Prof. Ciamician holds that it lies within our power to make plants produce abundantly the things we need. The possibility is indicated when we consider the ease with which we have increased the amount of sugar in the sugar beet and the percentage of protein in wheat.

The Energy of the Rotating Earth

In an introductory lecture to the engineering classes at University College, London, Prof. J. A. Fleming, in considering the sources of energy available to mankind, pointed out that the earth is a great flywheel. It whirls along in its orbit with a velocity of about twenty miles a second or 1,200 times that of an express train. Its rotational energy is a hundred thousand million billion horse-power hours, but the total orbital energy or energy of motion in its orbit is ten thousand times greater. "Suppose" said Prof. Fleming, "suppose we could in some way or other slow down its rotation so as to make the day just five minutes longer.

This would decrease the earth's angular velocity by about one third of one per cent and decrease the angular energy by about two thirds of one per cent, or say by 1/150 part. If then we could capture and store up the difference in the rotational energy in the two cases, it would give us about six million billion horse-power hours, or a billion horse-power for seventy thousand years. The energy we can obtain by the combustion of all the one thousand million tons of coal at present raised per year, sinks into insignificance compared with the enormous energy which would be set free by an almost imperceptible lengthening of the earth's diurnal rotation."

Prof. Fleming was not rash enough to indicate in what manner this unthinkable amount of energy could be utilized. Those who will attempt that will find themselves engaged in the mad task of designing perpetual motion machines.

The Energy of the Atom.

If Ramsay is correct in stating that copper and lead can be disintegrated, have we not here a source of energy? Sir William Ramsay has himself effectually disposed of that possibility. First, all metals, except gold and platinum, he has pointed out, are produced by the combustion of fuel; or, it may be, by electric power derived from turbines and dynamos. Hence they must be more costly than the means used in their production

tion; to produce them, not merely must energy be used, but also some must be degraded, and lost as heat. Labor, too, is expended in their production. On the supposition of change with evolution of energy, they would give out no more than has been put in, in converting the ores into the metals. Lastly, supposing that this compound can be induced to change, under the action of ultra violet light for example, the change is too slow to be effective as a source of energy, and ultra-violet light itself is produced only after much energy is expended.

Experiments conducted by Mr. Nikola Tesla with electromotive forces of 20,000,000 volts have convinced him that if 100,000,000 volts could be produced it might be possible to break down the atomic structure of any element and thus liberate a certain amount of energy. "But," he told the writer of this article, "even if the feat could be accomplished and sufficient energy set free, there still remains the enormously difficult problem of devising a means of utilizing the energy in a practical way."

Prof. J. A. Fleming suggests a somewhat similar course. "It is now pretty generally recognized," he argues, "that an atom is a complicated structure, a sort of solar system in miniature composed of revolving electrons. It may be possible to break down the structure by the action of impulses due to concentrated electric waves of the right period, setting up vibrations, which are resonant with some natural period of the atom, just as it is possible to break down a suspension bridge by a number of men jumping on it in time with its natural period of oscillation. If then the atom were to break down, the energy liberated might be far greater than that applied to it in the form of the resonant impulses."

Sir William Ramsay is undoubtedly right in maintaining that no source of energy, capable of being converted into work on a large scale, can be looked for, so far as the transmutation of matter is concerned. "The question is not—can it be done? but—does it pay to do it? And to the last question the answer is emphatically no."

Radium as a Source of Energy

So minute a quantity of pure radium as one gramme (one twenty-eighth of an ounce) yields 118 calories an hour, 2,900 a day, or nearly one million a year. A ton of radium, according to Sir William Ramsay containing a million grammes, would give one million million calories per year. As one gramme of coal in burning evolves about 8,500 calories, one ton would evolve one million times as much, or 8,500,000,000, which is only the 117th part of that evolved by the radium in a year. Moreover, the radium after the year has suffered merely a minute loss of weight, roughly speaking, about 1/3,500th of its weight has disappeared, hence before it was all "consumed" it would have evolved $117 \times 3{,}500 = 400{,}000$ times as much heat as an equal weight of coal. Add to this the fact that coal is utterly consumed in a few hours, but that rate of change of radium is all but imperceptible, and the superiority of radium over coal, weight for weight, is still more apparent.

Unfortunately, radium is about the scarcest producer of energy in the whole world. Radium is the offspring of uranium, it does not occur apart from uranium. Sir William Ramsay places the supply of uranium in its ores at about one million tons. Since the amount of uranium contained in the "kulm" shale of Sweden is under 0.5 per cent he concludes that the amount of radium metal in the whole world is not more than 500 pounds—too insignificant, in a word, for serious consideration as a substitute for coal. Not more than 125,000 tons of coal would be saved by utilizing the energy in 500 pounds of pure radium. The railway locomotives of the United States burn more than that quantity of fuel in a year. Besides, the energy in the five hundred pounds of radium cannot be liberated quickly, but must be spread over a period of centuries. The late Prof. Curie once remarked that he would not venture into a room containing only a pound of radium, so extraordinarily intense is its action. Hence, even if it were possible to hasten the discharge of radioactive energy, the engineers of a radium power plant would have to be recruited from the members of Stevenson's Suicide Club.

The Internal Heat of the Earth.

It is a matter of common knowledge that in sinking mining shafts there is a rise in temperature of about 1 deg. Fahr. for every 60 feet, down to a certain depth. Active volcanoes afford still more striking evidence of the earth's internal heat. Have we not here an inexhaustible source of energy? We have, but it is difficult, if not impossible, to utilize it. If the prime requisite in making use of any source of heat is to obtain good conditions of thermal interchange with it, an insuperable obstacle would be found in the poor conducting qualities of rock. Only by fluid convection would it be remotely possible to obtain communication with the earth's stores of heat. In considering these possibilities, the Hon. R. J. Strutt points out that hot springs, while they have been utilized from time immemorial, are too diminutive. The perpetual streams of molten lava that flow into the sea in certain localities, as at Stromboli, might perhaps be utilized for ventures, "but the opportunities for applying the method would scarcely be extensive enough to encourage inventors."

Why not pump water down to the heated interior and return it to the surface at a high temperature? Here again Strutt sees no possibilities. The pipes would have to be kept immersed in molten lava, no sufficiently rapid transference of heat to them from solid rock would be possible. For the same reason he states, the pipes must not be cooled down by the water flowing through them sufficiently to cause the surrounding lava to congeal. Can the pipes endure the prolonged action of molten basalt? Wrought iron might in Strutt's opinion. On the other hand, the margin of difference between the melting point of basalt and of iron is not very great, and lack of stiffness in iron pipes at such temperatures would undoubtedly introduce the most serious difficulties. Even if the attempt be made by directly attacking a volcanic crater the engineering difficulties would be enormous.

Similar conclusions were reached by Sir Charles A. Parsons in a presidential address to the engineering section of the British Association for the Advancement of Science. He discussed the feasibility of constructing a bore hole twelve miles deep. While the feat could be accomplished, and while the temperature of the rock at that depth is probably 272 deg. Fahr. the undertaking would involve an expenditure of millions.

The Future of the Windmill

A FEW years ago a collective report was made by American consuls throughout the world on the use of windmills in their several districts and the prospects of increasing the sales of American windmills in foreign countries. At that time the manufacture of windmills in this country had increased fourfold in ten years, indicating a rapid growth in their use by our own people. However, the report was, on the whole, rather discouraging. The use of windmills was found to have greatly decreased in the Old World. This was notably true in Holland, the country with which the windmill is traditionally associated. For the great national task of draining the polders wind mills were being rapidly replaced by steam pumps.

The greater number of European windmills were erected before the days of steam. This fact together with the relative inefficiency of the old fashioned European windmill shows that the decline in the use of these devices abroad is no indication of the future in store for the American windmill.

The American farmer uses the windmill chiefly for pumping water both for domestic purposes and for irrigation. To some extent it has been used for driving the minor machinery of the farm. Attempts to use it as a means of generating electricity for lighting and power purposes have hardly passed the experimental stage. That this will come in time seems inevitable and herein probably lies the greatest future utility of the windmill as an adjunct in farming as well as in other occupations.

The future developments in this line will be conditioned by the meteorology of the country and in this connection it is important to have accurate statistics of the average force and constancy of the winds in all sections. Such information is presented in brief form by Mr. P. C. Day of the Weather Bureau in an article published in the last Yearbook of the Department of Agriculture. A number of charts bring out clearly the great diversity in windiness in different parts of the country. Mr. Day takes a most hopeful view of the value of the wind as an asset in American agriculture.

The Current Supplement

IN this week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT Mr. W. H. Booth discusses industrial efficiency from the point of view of the chemical engineer.—Mr. P. W. Wilcox describes a new system of two-rudder control for aeroplanes.—E. Hesse contributes an article "The Housefly and How it Spreads Disease," in which he points out as a possible remedy against the fly pest a fungus which is parasitic upon the fly and kills it.—W. M. Davis writes on the theory of the origin of coral reefs by subsidence.—Th. A. Watson recites some interesting and amusing incidents from his connection with the early development of the telephone.—Walter Feld describes the direct production of ammonium sulphate from hydrogen sulphide and ammonia.—Sir J. J. Thomson's series of lectures on "The Structure of the Atom" begin in this week's issue.—Cooling towers are of importance in many manufacturing plants. A special system of such towers is described, and their efficiency discussed.—Mr. N. S. Neumark concludes his article on Peroxides and Persalts.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered but the names of correspondents will be withheld when so desired.]

Clipping a Hedge With a Torch

To the Editor of the SCIENTIFIC AMERICAN:

The day fast approaches when the "hedge" that incloses our suburban homes is about to start in business and cause the long-suffering commuter much concern. Hence the question: Has any of your readers ever tried to "clip" a hedge with a painter's gasoline torch? HEDGE-HOG.

New York city.

The Mississippi Floods

To the Editor of the SCIENTIFIC AMERICAN:

I am sorry to note the stand you take in the matter of straightening out a river, in your otherwise sane views of flood restrictions.

The problem of the Mississippi is identical with that of the brook, save in magnitude and constant level at outlet. A straightened bed will lower the flood crest by drawing the advance waters of a flood from hours to days sooner than if left to its tortuous course. Thus a large volume of oncoming waters is early disposed of, and the flood crest flattened and drawn or lengthened. This is surely a well-known fact, and easily demonstrated fortunately.

The importance of bank erosion is a close second to that of flood restriction and is happily prevented by simply straightening the channel. Surely this plain problem does not call for very much "gray matter." Begin at the mouth, straighten channel any distance, make waterway wide enough and dike high enough to take flood, with a good margin of safety added.

Littleton, Del. C. A. ZANDER.

Improvement in Carbureters

To the Editor of the SCIENTIFIC AMERICAN:

Much is being said about the auxiliary air valve working in connection with the carbureter. I have used such air valve three years, the valve being under hand control. By its use the increase in mileage runs from sixteen to twenty-two and twenty-five miles per gallon. The machine is small and the roads good.

A simple device for air hand control can be put on any car without much trouble. Cut a hole in a suitable place between the carbureter and engine, and cover it with a cone valve that can be opened or closed by a lever on the steering post. For a small car a three eighths-inch hole covered with a cone valve will serve.

Experience on the road will tell when to open the air supply. If opened too soon the engine will miss, if opened too wide the engine will miss. The harder the engine is working and the faster it is going the more the valve can be opened.

The use of the auxiliary air valve is not original with me. I got the idea from Homan's work on "Self-propelled Vehicles," using my own plans to accomplish the job. The material cost thirty cents. The work was done in a carpenter's shop, rather crude, of course, but answers an excellent purpose.

Pasadena, Cal. WILLIAM YOUNG.

That Granite Chipping Machine

To the Editor of the SCIENTIFIC AMERICAN:

I notice the article in your correspondence column of February 22nd, in which a machine is wanted for chipping granite cubes, which is certainly much to be desired.

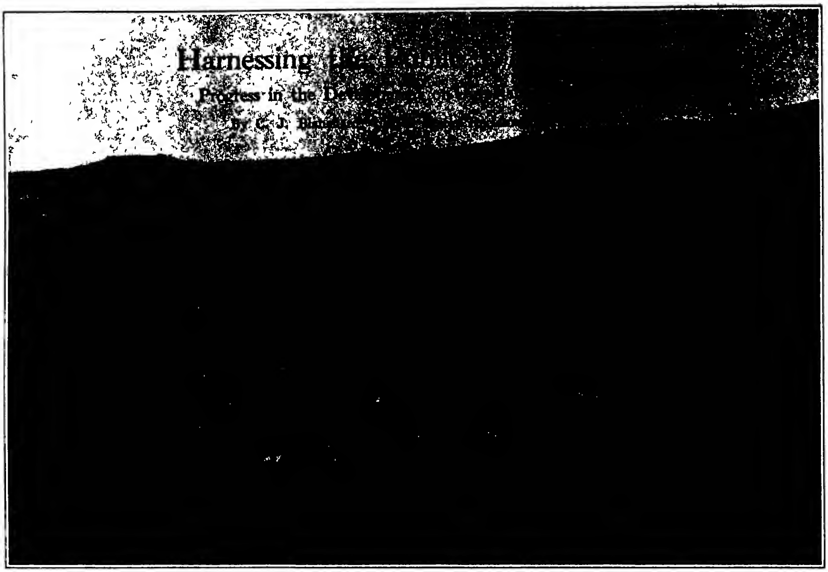
This city alone uses from eight to ten million a year, and nothing else seems to be able to stand up under heavy conditions of traffic. Advance has been made in every line of industry except the granite block industry, which has stood still for upward of two hundred years, save that drilling is now done by pneumatic tools instead of hand drills, but nothing has as yet been devised that will even compete in cost of production with the present extravagant methods of hand labor. There are firms in this line in Chicago who would no doubt advance money for any plan that appeared practical and pay handsomely in royalty for machines or any contrivance that would equal the present hand labor cost of getting out these granite blocks.

Throughout all this middle West there are two sizes in general use. One is 8 inches to 12 inches long, 4 inches to 5 inches in width, and 5 inches to $5\frac{1}{2}$ inches in depth, the other is 6 inches to 10 inches long, $3\frac{1}{2}$ inches to $4\frac{1}{4}$ inches in width, and $3\frac{3}{4}$ inches to $4\frac{1}{4}$ inches in depth.

To the man or the men who can devise something practical along this line, a fortune awaits them.

SUPERIOR CONSTRUCTION COMPANY,

Chicago, Ill. Per J. A. MCGINN.



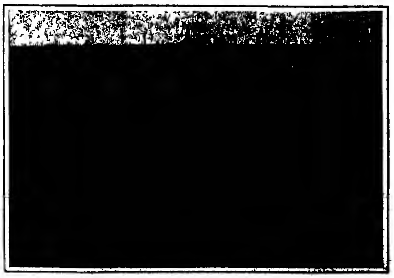
The Boise project, Idaho. Bird's eye view of the completed power plant and surroundings.

UPON the adoption by Congress of a comprehensive and practical water power policy depends to a great extent the future development and progress of a large part of the West and in a somewhat lesser degree of many parts of the East, South and Middle West. The time is ripe just now for an adjustment of the differences which have existed between the federal authorities, the States and private interests, and a definite policy is looked for in the near future. Indeed a long step in this direction was taken during the closing hours of the last administration when plans for State and federal co-operation were formulated and the Department of the Interior in an agreement with a large power company in Montana secured recognition of its right to make certain provisions for the regulation of rates to govern the operations of this company which desired to use some of the public domain. As a result of this agreement the electrification of probably four hundred miles of a transcontinental railway is practically assured and a new market for the "white coal" of the West is provided. A precedent has been established and the bugaboo of Government regulation tying up development has been laid on the shelf for the time being. If one of the largest power companies in the West and a transcontinental railroad have found it possible to enter into an entirely satisfactory agreement with the Department of the Interior notwithstanding the present notoriously inadequate laws, future complaints by promoters and exploiters that their plans for development are prevented by departmental red tape will perhaps not be accepted with the same confidence by the public and the press. It has not always been the fault of the Department that private enterprises have been checked and halted. More often the fault has been with Congress, which while enacting laws for withdrawals and reservations has persistently declined to provide legislation to enable the Department to unlock the storehouse in order to permit utilization and development for the public.

Representatives of the Departments of the Interior and Agriculture during the past year held numerous conferences which resulted in a comprehensive revision of the regulations governing the water power permits in national forests and on the public domain generally. Later a largely attended conference was held with representative water power interests and of the State conservation water and varied commissions of California. There were discussions of the relations between the State and national governments with respect to water power and modifications in the laws and regulations in order to co-ordinate the functions of the nation and the States. This conference was extremely illuminating in that it fully demonstrated the feasibility of effective co-operation.

Government Construction of Power Plants.

In the working out of a definite plan for the utilization of our natural resources and particularly the water powers, only one federal bureau has been actually engaged in the engineering work of developing power. The Reclamation Service, organized in 1902 for the purpose of making habitable large areas of irrigable public lands, has constructed a number of power plants and has launched the Government in the power producing business in several localities. Originally the idea of power development was solely for the purpose of pumping water to lands above the reach of the gravity canals, but wise management decreed when there was demand for surplus power, that all such power which could be economically developed should be provided for in the construction of the plant. In this way the Government has found itself in the field as a maker and seller of electric power. It is a rather advanced step in governmental activities, but no one has yet seriously questioned its practicability and certainly no one can gainsay its success financially. It is understood that the Government's control of these public utilities is not to be permanent, as it is contemplated in time that their operation and maintenance as well as the revenues will be turned over to the people who have assessed themselves to repay to the Government its investment. The Government in this connection might be regarded as in the position of a contractor who has built and is operating its plant until its owners have met their obligations to him.



The great Minidoka dam across Snake River.

The following table shows the present condition as well as the possibilities of power development on the reclamation projects.

Project.	Power Developed, H P	Possible Power
Ariz., Salt River	9,030	20 000
Ariz. Yuma		600
Cal., Orland		*
Colo., Uncompahgre		10,000
Colo., Grand Valley		2,000
Idaho, Boise	3,000	3,000
Idaho, Minidoka	10 000	30,000
Mont., Huntley	350	880
Mont., Lower Yellowstone		290
Mont., Sun River		*
Mont., Flathead		300,000
Neb. Wyo. North Platte		*
Nev., Truckee-Carson	1,660	6,000
N Mex. Rio Grande		*
N Dak., Williston	3,000	2,000
Ore Klamath		*
Ore., Umatilla		75
Utah, Strawberry Valley	1 600	3,500
Wash., Yakima		15,000
Wyo., Shoshone		*
Total	27,670	394,345

* Not determined.

Minidoka Project, Power Plant.

The largest individual development of

power by the Government is on the Minidoka project in Idaho, where at the present time 10,000 horse-power is utilized. It might be stated that on this project as well as on all others the primary use of the power is to meet the needs of irrigation. After this need is supplied the surplus, if any, is marketed commercially for the needs of the public and private interests.

The Minidoka power house is located in the great Minidoka dam across Snake River. The water which moves the turbines is water which does not belong to the Government, but is decreed by prior right to irrigation projects below, in the neighborhood of Twin Falls. Before it is permitted to pass to its rightful owners the Government exacts a toll of 10,000 horse-power, which is advantageously applied to many uses on the Minidoka project. The first and greatest use is for pumping upon high lands. The current is generated in five separate units of a total of 7,000 kilowatts and transmitted about 13 miles at a pressure of 33,000 volts, to three pumping stations which pump about 650 cubic feet per second to a height of 31 feet above the gravity canal. At this level 10,000 acres are irrigated, the balance of the water being then lifted 31 feet higher, and part of it applied to 15,000 acres. The remainder is then lifted an additional 31 feet and supplies 23,000 acres. This constitutes the largest pumping plant for irrigation in the world. Notwithstanding the large utilization of the power for irrigation needs there remains a substantial surplus for which it was necessary to establish a market. Being a constant force, and not limited as on several other projects to the irrigation season, it was important that arrangements should be made to dispose of the unused power. The heaviest demand for electrical energy occurs during the irrigation season. In the winter this demand ceases entirely. As the flow of the stream continues throughout the year, power is available in winter as well as in summer, and it has been deemed expedient to make special inducements to the towns on the project to use it. Encouraged by a very low price, citizens of Burley, Heyburn and Rupert have made contracts with the Reclamation Service. At the prices made to them heat can be furnished by means of electric heaters at approximately the price of coal. Its greater convenience and cleanliness has led to such use to a considerable extent. The demand is steadily growing, but still is behind the supply. In addition to heating and lighting the stores and homes, the family cooking in many homes is now being done by electricity.

A very advantageous contract was made a short time ago with a newly established sugar factory at Burley. The first month's rental of power produced a revenue of $1,800 to the Government.

An effort is being made to secure the consumption of the balance of this water power by encouraging the installation of a manufactory of nitrogen products for fertilizer and other uses. It is believed that these negotiations will prove successful as well as others for establishing special industries adapted to intermittent use of power.

The Salt River Project, Arizona.

On this project, by reason of its large storage, the all year-around irrigation, and numerous drops in the main canals, the power possibilities far exceed the requirements of irrigation pumping. Owing to the varying head in the reservoir, which is to be utilized upon the wheels, the power is fluctuating in character at the Roosevelt dam. This disadvantage is compensated for in a measure however, by the fact that the demand for power is great and the rate obtainable sufficiently remunerative to warrant an expenditure on the part of the Government necessary to develop a plant of maximum capacity. The surplus power at the Roosevelt dam has been leased to a prominent mining company which, owing to the high cost of fuel, found it profitable to pay ¾ of a cent per kilowatt hour for all power taken under a contract which does not obligate the Government to continuous delivery. This of course forces upon the company the necessity of having in readiness at all times an auxiliary steam plant for operation on short notice. Under this same contract the Government may in time of need use the steam plant of the company for its own purposes. This most fortunate conservation of the entire power possibilities at this point will in the long run prove profitable to the irrigators under the project.

The co-operation of the farmers and their appreciation of the value and importance of developing all the power possibilities in the valley are evidenced by a bond issue made by them recently in the sum of $900,000, which amount is now being expended in accordance with plans of the Reclamation Service to construct a number of power plants in the valley utilizing the drops in the main canals. One of the canal power plants is serving to supply a local company which delivers power to the city of Phoenix. The revenue to the Government for this power amounts to between $5,000 and $6,000 per month. Another contract has been let to the Sugar Company at 1¼ cents per kilowatt hour, another to the town of Glendale at a maximum of 5.51 cents per kilowatt hour, another to the Arizona Alfalfa Mill Company at 1¼ cents per kilowatt hour, etc. It is conservative to state that the ultimate gross revenues from the power on the Salt River project will exceed a million dollars annually when the maximum development has taken place.

It should not be forgotten that notwithstanding this large revenue return in the way of cash rental for power the same plants will pump water from wells to irrigate 40,000 acres. As this land comprises some of the finest orange land in the valley it is safe to say that electric power will in this way add $8,000,000 to the taxable wealth of the valley in land values alone. In producing orchards this land will be worth double this amount.

Strawberry Valley, Utah, Project

On this project the Government planned its power plant primarily for the purpose of using the electrical energy in the construction of a remarkable tunnel. A description of this tunnel was published in last week's issue of the SCIENTIFIC AMERICAN. It pierces the Wasatch range at a point where the mountain is four miles thick and conveys the water of a stream formerly emptying into the Gulf of California into a valley which has no outlet to the sea. From the power plant on the western slope to the eastern portal the distance was 25 miles across a rugged mountain country. The waters of Spanish Fork River were diverted into a power canal which supplied the turbines and about 1,000 horse-power was developed. Part of this power for some time has been leased to the towns of Spanish Fork, Payson and Salem at rates ranging from 8/10 cent to 1 1/2 cents per kilowatt hour, the lower rate calling for a minimum total of $225 per month and the higher rate for $60 per month.

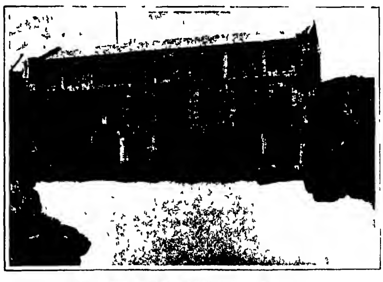
Electric Power for Construction

The Reclamation Service has not hesitated to install heavy power plants in connection with its construction work in the West. At the present time it is building near Boise, Idaho, the highest dam in the world and is using for this purpose power transmitted 24 miles from its power plant on Boise River where 3,000 horse-power are developed.

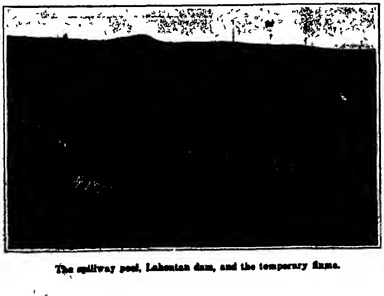
On the Truckee-Carson project in Nevada 1,000 horse-power are generated in the Government plant, a portion of which is required in building the Lahontan

(Concluded on page 323.)

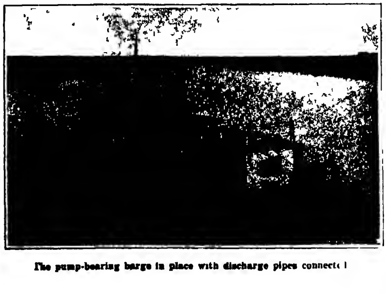
Uncle Sam's coal mine and miners on the Williston project



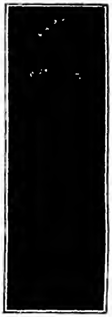
Power house of the Minidoka irrigation project



The spillway pool, Lahontan dam, and the temporary flume.

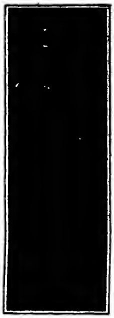


The pump-bearing barge in place with discharge pipes connected

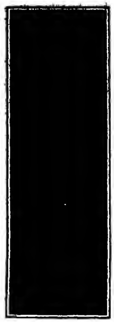


Type A insulator at 160 kilovolts.

Type C at 265 kilovolts.



Type D (five sections) at 280 kilovolts with connecting hook protected and unprotected.



Type E (8 sections) at 310 kilovolts.

Type F at 300 kilovolts.

Suspension Insulators Suitable for 110,000-volt Transmission

Tests Showing the Weaknesses of Standard Types

By Joseph B. Baker

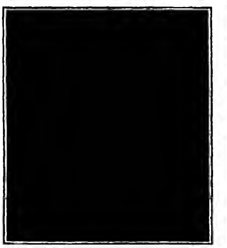
THE constant tendency to increase the voltage of electric transmission lines in order to deliver energy over longer distances and with reduced lines loss has presented for solution many problems of insulation. Both the terminal apparatus and the connecting lines must be insulated so *strongly* that the high pressures employed and especially the abnormally high potentials due to sudden and transient surges, will not result in breakdown of line or apparatus with its serious consequences. The resistance and dielectric strength of insulations used in electrical machinery at generating and sub-stations—generators, transformers, rotary converters, etc.—has been well worked out by designing engineers and electrical manufacturers in response to the demand for higher and higher voltage equipment but the protection of the line itself which is not localized in a small space under a sheltering roof but runs for many miles through the open country, strung overhead on poles and exposed to all atmospheric conditions, has been in a comparatively backward state. In the old days, when generators and transformers were built with shellacked cotton insulated wire windings, the lines from the power station were strung on ordinary glass insulators, like those used for telegraph and telephone wires. Later, when better insulations for the machinery were developed in recognition of the fact that high and durable insulation is an essential of continued and economical operation the pole lines likewise received attention, and special porcelain insulators began to be used, but up to a very recent date high tension line insulators—nowadays consisting of a series of insulator sections, or units, affording a long and high resistance barrier against leakage of electricity—have been designed more in accordance with the individual views of their makers than with any definite electrical and mechanical requirements.

In a paper recently presented before the American Institute of Electrical Engineers, Mr. P. W. Sothman of New York describes an investigation of a number of different types of high tension suspension insulators that he made in order to select a suitable high-tension insulator for a transmission line operating at 110 000 volts—a voltage at which the question of insulation is of the greatest importance since very little reliable data was available as to the operation of insulators for potentials above 80 000 volts.

At the outset of this investigation, upon visiting the different insulator factories and witnessing manufacturers tests on insulators which they *proposed for this* work it was clearly seen that the most widely varying methods of testing were employed so that an insulator showed entirely different results, depending on where and by whom it was tested. There seemed to be no recognised standard in the testing conditions or in the method or interpreting the effects observed; so that it was impossible to arrive at definite conclusions of value in the actual installation of the insulators on a power transmission line. For the new investigation it was therefore determined to establish absolutely unvarying conditions and a definite line of reasoning to be followed *in classifying the results obtained*.

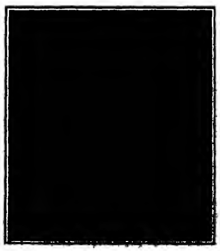
The testing equipment was one having plenty of *power* (as well as high voltage), and was so arranged that the conditions could be controlled and changed at will. For the open air electrical tests of the suspension insulators, a piece of gas pipe was supported horizontally, resting at each end on a 60 000-volt pin type insulator at a convenient height above a large platform. The general view of the testing apparatus for suspension insulators shows several of these insulators hung vertically from this gas pipe support, but the insulators were tested one at a time, being placed in the middle of the support while under test, with all the other "candidates" crowded to one side out of the way. The same platform and arrangements were used for the electrical tests of the strain insulators that were investigated, except that the insulator under test was held by tackles in a horizontal position with two other insulators at the ends of the tackles to prevent leakage to ground. For supplying the testing voltage two 50-kilowatt, 150,000-volt transformers were used, giving a maximum voltage of a little over 330,000 (330 kv.). The voltage was controlled by a water rheostat in the low-tension circuit, and readings were taken on a special voltmeter calibrated with spark-gap.

The tests on each insulator comprised "dry tests" consisting of a flash-over test on each section of the insulator in order to exclude defective or punctured units, and a potential test on the complete insulator and on a less number of sections than the total number in the insulator, wet test (insulator exposed to artificial rain), test of all of the insulators in parallel, in order to observe closely relative performance when exposed to identical voltage and conditions, puncture test, with the insulator immersed in oil, since the potential required to puncture a sound insulator is greater than the flashover voltage, test of mechanical strength made with a simple pulling contrivance and dynamometer. An interesting feature of the work was the method of simulating rain, in the wet tests—by an adjustable comb of water-pipe nozzles arranged to shower the "rain" over the insulator. By using two groups of nozzles and adjusting their distance from the insulator under test, the angular precipitation of their streams and the amount of rain supplied per



Type D with hook unprotected.

Testing platform for suspension insulators.



Type D protected by bottle-shaped shield.

minute (measured by a special rain-gage) was placed under perfect control.

The electrical tests illustrated were made at night and in complete darkness, so that distinct observations could be made of all electrical effects by the eye and by the camera, and the photographs which constituted a permanent record of the work were identified by the time shown by a clock placed near the insulator under test. The voltage applied to the insulators was raised by successive steps. Assuming that the luminous display was in proportion to the power leaking past the insulator, it was deemed fair to judge the quality of the insulator by comparing the amount of the display and the voltage that was required to give same. In deciding the net relative value of a given insulator and the influence of its design, other observations were considered the gradual increase of luminosity, or the appearance of a sudden display on raising the voltage, the appearance of the display at certain points and not at others on the insulator, etc The five types of suspension insulators as seen by daylight, and one of the strain insulators that was tested, are shown herewith. The photographs on the opposite page illustrate the performance of the insulators under rain at an angle of 45 degrees and at the rate of one half inch of water per minute.

Type A met the mechanical requirements (by showing a breaking strain exceeding 8,000 pounds) but not the electrical requirements. As the voltage was raised a discharge became visible at 150 kilovolts, and the insulator broke down at 160 kilovolts. The appearance of this five-unit insulator at 160 kilovolts shows the imminent breakdown as due to excessive leakage, the entire insulator virtually becoming conducting There was another important feature characteristic of every insulator having metal fittings which are in the least degree non-symmetrical about the axis of the insulator, viz., the uneven static field or dielectric stress, most intense at projecting metal points and always causing premature failure of the insulator, the discharge of the insulator is started in almost every case at the projecting point

Type C insulator also showed up better mechanically than electrically, although it was judged to be too fragile in ordinary handling. It began to show luminous effects at 225 kilovolts, and failed by flashover at 265 kilovolts. This insulator furnishes another instance of uneven dielectric stress, the effect of which is very marked in the reproduced photograph of the insulator in the act of breaking down—particularly at the point of discharge at the left of the cap in the second section from the top.

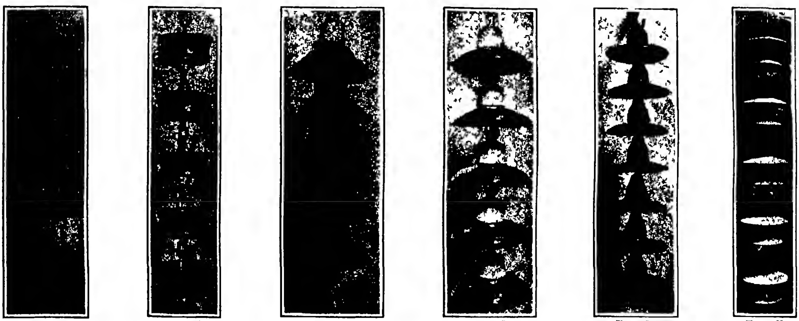
Type D is shown breaking down at 280 kilovolts by flashover The illustrations of this insulator under test show the localized discharges from projecting points and backs of the hooks used to link the sections together, and the marked effect of protecting the hook by a bottle-shaped metal shield giving a symmetrical instead of a non-symmetrical metal surface.

The eight-unit Type E insulator is shown in the act of failing at 310 kilovolts in consequence of strong leakage from section to section. Heavy discharges are occurring at the cotter pins in the caps.

Type F, an insulator of European design and manufacture, made the best showing of all. The photograph shows this five-section insulator flashing over from section to section at 300 kilovolts. The performance of each section, revealed to the camera by the luminous discharges, presents an interesting study This insulator failed to meet the mechanical tests only because the cement joining the different pieces in each unit had not properly set It met the electrical requirements well, showed high-class workmanship and material

Final selection of the Type E insulator was made in consideration of its good electrical points as demonstrated by the tests on the eight-section insulator, and because better deliveries could be made for the actual line construction than could be expected for the foreign-made insulator, Type F The large number of open spaces in this unit are of advantage Although the insulator did not meet the mechanical specification requirements (owing to the fact that the cement had not properly set, the insulator broke at an average stress of 7,650 pounds, the required breaking stress being 8,000 pounds) it was judged to be strong light durable, and compact and susceptible of improvements by slight changes in the design A subsequent increase in diameter increased the electrical efficiency substantially, and the method of connecting units together was modified so as to present a smooth and symmetrical surface to prevent premature discharge

The strain insulator Type C did not meet the requirements under the wet test by reason of the excessive leakage at potentials below the specified standard of 220 kilovolts (twice the line voltage) Other types that were submitted for test having also failed a ten unit Type E insulator with a modified design of cap to increase the strength, was finally adopted as the least unsatisfactory strain insulator to use



Type A. Type B. Type C. Type D Type E. Type F

Suspension insulators submitted for test

Types A, C, D E, and F are regular suspension insulators, Type B being a proposed strain insulator

Serious Plight of an Arctic Expedition

A PARTY of Norwegians under Capt Staxrud has gone from Tromsö to the rescue of the Schroder Stranz expedition, now supposed to be in dire straits in Spitzbergen.

It will be recalled that Lieut. Schröder-Stranz, a German, recently organized an expedition for the purpose of making the Northeast Passage an undertaking which, along with much incidental exploring *en route* was expected to take three or four years The party included eleven Germans—some of considerable scientific eminence—and five Norwegians. In order to obtain preliminary training under Arctic conditions, a trip to Spitzbergen was undertaken last summer The party sailed early last August in the ship Herzog Ernst ' a two-master of 61 tons, under the command of Capt Ritscher, and at first attempted to push north along the ice-obstructed east coast of Spitzbergen As this proved impracticable, the explorers proceeded up the west coast, and the leader, with three companions, left the ship for a trip over the pack ice in the hope of reaching and crossing Northeast Land while the vessel put into Treurenberg Bay to await their return

On September 10th, as Schröder-Stranz had not returned and the ship was frozen in for the winter with but a meager supply of provisions on board all the Germans and two Norwegians set out on an attempted overland journey to the American coal mines at Advent Bay and the neighboring wireless telegraph station at Green Harbor. Only Capt. Ritscher succeeded in reaching Advent Bay, on December 27th, after suffering great hardships. The rest of the party had split up into several detachments and had mostly taken refuge in three Norwegian fishing huts, widely separated from one another Capt Ritscher said that the expedition had only provisions for one month at the most and that most of the party were he feared in the last stages of scurvy Nothing is known concerning the fate of Schröder-Stranz and his companions nor of two Germans, Dr Detmers and Dr Moeser who took a different route from the rest of the party after leaving the ship The situation of the whole expedition appears to be precarious.

The Destruction of the German Dirigible "L. Z. 15."

By Carl Dienstbach

SO many trips have been made in safety by the giant Zeppelin airships within recent months that the discouragement engendered by the frequent wrecks of the past was all but removed. Indeed German airship builders were taxed to their utmost in the effort to construct new rigid vessels In the midst of this development came the news of the destruction of the most modern and improved though not the largest, of the Zeppelins, the new military L. Z. 15.

How did this accident happen? So far as can be at present determined this seems to have been what may be called a "legitimate" accident, in other words an accident no more avoidable than are the accidents to which trains and steamers are subject It happened during a storm which played havoc with small shipping in the harbor of Hamburg and caused many deaths from drowning. The safeguards with which all Zeppelins are now provided as a result of former disastrous experiences, proved inadequate in this particular case It is now the rule that in a storm a Zeppelin may land only on perfectly level unobstructed ground and at a distance, moreover sufficiently far from any building or other large obstacle which may churn up the wind. According to the orders the airship is not anchored, but only held fully manned with engines running. If a heavy gust threatens destruction the ship is immediately released so that it may seek refuge in the air When the danger has subsided the vessel may return seizing the first favorable opportunity to glide into its shed The writer saw the Hansa enter the shed at Hamburg with the men holding her and running as fast as their legs could carry them two of the airship's propellers accelerating their progress.

The L. Z. 15 had been navigating in heavy weather for nineteen hours and had landed only to replenish her fuel, nearly all of which had been utilized in overcoming the storm The attempt to anchor the ship so as to facilitate the replenishing of the fuel supply was the primary cause of the accident To have ascended again without sufficient fuel would indeed have been hardly less precarious.

The L. Z. 15 had just been accepted by the military authorities. Competent as her military crew was there is strong reason to believe that had she been handled by the old, seasoned "air dogs" of the passenger service many of whom were veteran seamen she might have escaped injury As it was, she was wrecked by tremendous gusts which pounded her against the ground before she had been completely anchored All the machinery and equipment remained intact No one was injured It may be safely predicted that in the future a sufficient amount of fuel will be kept in reserve by the captains of all Zeppelins, whether their ships be engaged in the military or the passenger service

Fighting the Chestnut Bark Disease

The State of Pennsylvania's Work

THE State of Pennsylvania is waging a strange warfare against the spread of a destructive pest known as the chestnut bark disease. This vigorous attempt on the part of the State to control so virulent a disease is unique in that it is the first organized endeavor of its kind since the disease was first recognized as a serious menace to the chestnut trees in the vicinity of New York city in 1904. Not relying upon mere individual effort, Pennsylvania opened in 1910 an official contest with this pest and at once began to investigate the disease itself and to control its spread. By this time the disease had been reported from nine States, but with Pennsylvania-like thrift and thoroughness no less than an entire stop in the advance of the disease is sought. This undertaking of the State is being closely watched by pathologists and foresters all over the world and it is regarded as one of the greatest problems in vegetable pathology, involving the application of means of pest control and extermination which have never before been put into practice on such an extensive scale. Yet vegetable pathologists claim that the control and ultimate extermination of the *Diaporthe parasitica*, as botanists call the chestnut bark disease, will sooner or later become a real accomplishment.

Viewed even in the most hopeful way this invasion of a comparatively new pest is a fearful portent to the chestnut throughout its entire range of growth and threatens a total destruction of one of our most valuable timber trees. If the blight once gets fairly distributed over all the States in which chestnut trees occur naturally the problem will become infinitely more difficult. The magnitude of the task of controlling the spread of the disease, which still remains fairly well confined to certain areas, cannot be overestimated. It is realized that this enemy in its condition of advance is too formidable to be coped with even by the thoroughly organized State experts. The disease is decidedly of national importance and for this reason the United States Department of Agriculture is co-operating in the work and is doing everything in its power to aid the State in its great undertaking. Literature warning against the pest is officially circulated throughout the chestnut belt and especially within the districts adjacent to the infected regions. The aid of the private owners of timber lands is solicited and thus far a good many have volunteered to co-operate with the State authorities to remove all advance infections.

The spread of the chestnut blight is westward across the State and the object of the Blight Commission is to check its advance. This is done by felling all infected trees along the border of the blighted zone. The bark is carefully removed from the merchantable part of the trunk and burned together with the branches and small twigs. The bark is also removed from all the stumps and burned. To quote from one of the official reports of the Pennsylvania Chestnut Tree Blight Commission:

> The advance line at the present time extends through eastern Bedford County to central Huntingdon, Center and Clinton, Tioga and northeastern Bradford counties. Up to the present time over 32,000 blighted trees have been destroyed in the western part of the State, representing over a thousand infected spots. It is expected that by reinspecting these spots another year the disease will be eradicated from the locality. In this way it is hoped to keep the disease from advancing further across the State.

A great amount of useful systematic work against this dreaded bark disease has been done since the State undertook its control and eradication. So perfected have the methods become that the sporadic outbreaks along the line of advance of the disease are quickly located and the trees destroyed. Burning is the only practical destroyer of this fungus, and every spot in the forest that is infected is located and the search for them is continued. The expert does his work well, but after him comes a still more competent searcher and after him possibly still another picked from the long list of available field men. The work has progressed sufficiently far to say that local control of its spread has been effected by this method of double, triple, and in some cases quadruple checking or locating spots of infected trees. It is hoped that by resolutely thorough working from the circumference to the center the authorities will be able to keep the pest securely penned. As in all animal and vegetable pathology, prevention is the best cure. Other methods of controlling its spread are employed, and the one which has invited most extensive speculation in the press is the well known, though thoroughly impracticable, method of spraying with Bordeaux mixture. The purpose of spraying, which can be done only on a small scale, is to disinfect all wounds or abrasions in the bark, which would otherwise serve as a means of entrance of the spores of the fungus. If the Bordeaux mixture comes in contact with the spores it will prevent their germination. As soon as the spores have gained an entrance in a fresh untreated wound they will germinate and spread very rapidly in all directions in the living inner bark until the mycelia completely girdle the tree attacked. A canker is developed wherever the fungus succeeds in gaining entrance, and if these spots are discovered before the fungus has encircled the trunk or branch they may be removed by cutting out the lesions and water-proofing and sterilizing the wounds. The water-proofing material used is a mixture consisting of two parts of pine tar and one part of creosote with sufficient lamp black to give desired color. Rosin is also used to supplement the tree-surgery work in the trees that have been sprayed with Bordeaux mixture.

Spraying, as has been said above, is impracticable and is employed only in cases where a few trees are to be saved. It has been demonstrated that spraying acts as a preventive to the germination of the spores of the fungus which causes this trouble. On a large private estate at Kennett Square, Pennsylvania, about fifty large chestnut trees were saved by the spraying process. The trees were sprayed every ten days or two weeks from April to November in 1912. These are now in a healthy condition, and as far as can be determined by close examination show scarcely any signs of blight. A few trees in the woodlot which were not sprayed nor surgically treated had to be removed because they were all badly blighted.

The treatment of cankers is resorted to only in cases of ornamental chestnut trees and of horticultural varieties planted in orchards. The results so far attained with this method of local treatment have more than justified the necessary outlay. Backed thus far by a liberal appropriation the Commission has succeeded in preventing the pest from acquiring very serious headway.

The spread of the blight is westward. To check that spread it is necessary to cut blight-killed chestnut into cordwood, oak and other hardwoods remain.

Sample of tree surgery. A healed wound of canker was removed. The treatment of cankers is resorted to only in cases of ornamental trees.

Spraying with Bordeaux mixture is thoroughly impracticable and is carried out only in cases where a few trees are to be saved

Spraying outfit used at Kennett Square, Pennsylvania. Spraying can be done only on a small scale and serves merely to disinfect wounds or abrasions in the bark

Cutting blight-killed chestnut into lumber. The trees are felled along the border of the blighted zone. The bark is carefully removed and burned; the merchantable part is sold.

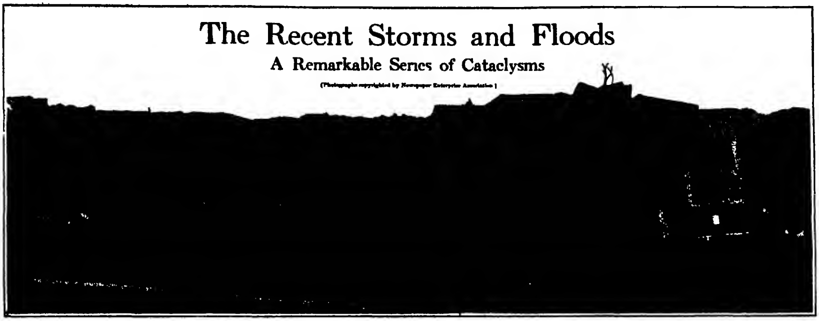
Night Plowing

A NOVEL departure is reported to have been made in New South Wales by starting plowing at night. For this purpose two powerful acetylene headlights are attached to the traction engine which draws the plows, and the ground is so well and brilliantly lighted that the operator can work over the field quite as well as by daylight. Departures of this character frequently lead to many improvements in the application, operation and adjustment of the lights.

The Recent Storms and Floods

A Remarkable Series of Cataclysms

(Photographs copyrighted by Newspaper Enterprise Association.)



One house blown against another A curious result of the tornado's power

THE storms and floods of the latter part of March, 1913, will rank among the greatest meteorological disasters in the history of this country. It is too soon to attempt a detailed analysis of these occurrences, from either a theoretical or a practical point of view, since up to the present writing both Weather Bureau reports and press dispatches from the stricken district are much curtailed by the interruption of telegraphic and other means of communication. The salient facts, however, may be stated as follows:

On Sunday morning, March 23, a well defined and symmetrical cyclonic disturbance overlay the western half of the United States with its center over Colorado. The winds were everywhere moderate, and, above all, the cyclone did not exhibit any of the characteristics regarded by weather forecasters as harbingers of tornadoes. The morning weather map of that date shows none of the distortion of the isobars into a V shape that indicates a tendency to line-squalls. At 8 P. M. (Eastern time) the storm had moved into a direction and at a rate that was in no way abnormal and was central near Omaha. The isobars were still symmetrical. For some reason that is hard to apparent from the weather maps, violent thunderstorms and scattered tornadoes occurred Sunday afternoon and evening over a broad zone on the right side of the cyclone's path. It is especially remarkable that a tornado occurred at Omaha almost at the very center of the cyclone, at about 6 P. M. local time. As a rule, tornadoes develop several hundred miles southeast of a cyclonic center.

From the fragmentary information now at hand, it appears that the tornadoes which occurred in Nebraska, Iowa, Illinois, Indiana, Michigan, and Wisconsin occasioned an aggregate loss of about 240 lives, that some 700 people were injured, and that $5,000,000 worth of property was destroyed. Much the heaviest losses occurred at Omaha, but this does not mean necessarily that the winds were more violent at that point than anywhere else; the area of devastation in a tornado is always small, and the amount of damage done in a populous city is, of course, much greater than in small towns or the open country.

In their destructiveness the tornadoes of March 23rd were among the worst this country has ever experienced. In the number of fatalities by which they were attended they have probably been surpassed only by the tornadoes of May 24th to 27th, 1896, which included the terrible St. Louis tornado of May 27th. The latter, though not relatively severe, passed through a great city and destroyed 306 lives, besides damaging property to the value of nearly thirteen million dollars.

The cyclone that occasioned the recent disasters passed into eastern Canada on Monday and rapidly left the continent. In the meantime a long trough of low barometric pressure spread up from the southwest and by the morning of March 25th its axis extended along the whole length of the Ohio Valley. It was attended by heavy rains, especially over the northern watershed of the Ohio, where equally heavy rains had occurred on Sunday and Monday in connection with the previous depression. This continuous downpour turned the northern tributaries of the Ohio into raging torrents, and on the 25th the southern valleys of Ohio and Indiana were submerged. These conditions were unprecedented. Previous great floods of the Ohio Valley have generally been due to the main river overflowing its banks; under these circumstances, the antecedent conditions usually give ample warning of what is to happen, and the progress of the flood-crest down the stream is relatively slow. In the present case a huge freshet occurred suddenly in the whole complex of smaller streams on the northern watershed, where the elaborate system of river gages and rainfall stations, which make flood prediction in the main rivers an easy task, was of no avail.

Automobiles were blown down from a viaduct.

A resident of Omaha collecting his belongings after the tornado.

On the 26th the rainfall area spread over the southern watershed of the Ohio, and the enormous contributions of water from both sides soon raised that river above flood stage. The colossal disasters, however, which will make the floods of March, 1913, historic were those which came unheralded on the 25th along the northern tributaries of the Ohio. The details are still fresh in the public mind and need not be recapitulated here. By the 27th the cyclonic area had passed east to the Atlantic seaboard and was followed by a rapid fall in temperature over the flooded region, greatly adding to the suffering of the homeless people. The storms and floods had paralyzed the railways and the telephone and telegraph lines, so that the work of rescue in which the whole nation co-operated was greatly hampered.

A practical consideration in connection with this appalling flood is that, though it is altogether unprecedented in magnitude in the history of the region concerned, it may be equaled or even surpassed in the future unless some rational measures are taken to control the head waters of our great rivers.

An Improvement in Electro Deposition.—A patent has been granted to Stefano Consigliere of Genoa, Italy, for a process and apparatus relating to the electro deposition of metals and wherein a multiplicity of loose small relatively heavy bodies are arranged in the receptacle for electrolyte and which will operate to beat and roll upon the coating deposited in order to render it more compact and resistant.

A Cascade of Stone

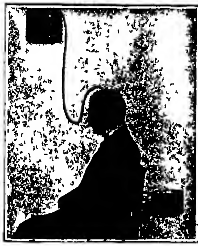
A REMARKABLE calcareous formation is to be found in Algeria about sixty miles from Constantine, the ancient Cirta. It looks like a magnificent cascade with the water in violent motion pouring over a rocky cliff in turbulent and riotous confusion and yet the cascade is as motionless and silent as the photograph reproduced herewith. It is as though a great waterfall had suddenly turned to stone. Naturally the natives look upon this phenomenon with great awe. They have given it the name Hammam-Meskhutin, which means the bath of the damned. They have a legend that the waterfall was turned to stone together with the members of an impious tribe who had incurred the wrath of Allah. At night these petrified individuals, according to the story, are restored to life and resume their normal shapes. The petrified waterfall has been produced by calcareous deposits from hot sulphurous and ferruginous mineral springs. The springs have a temperature of 95 deg. Cent. The deposits have, of course, been making for many centuries. The hot springs were known to the ancient Romans. We are indebted to the *Illustrated London News* for these facts and for the accompanying photograph.

The petrified cascade of Hamman-Meskhutin, Algeria.

The conduits of the hydro-electric power plant at Gatun for operating the Panama Canal.

Head Cooling Apparatus

THE man pictured in the accompanying photograph is not a hot-headed individual undergoing treatment to allay his angry passions, as one might suppose upon reading the caption. He is merely wearing a cooling coil designed by a Vienna doctor as a physical aid to medical treatment. Modern advances in therapeutics have scientifically established and widely extended the utility of thermal methods of treatment. Innumerable cases might be instanced, says the inventor, in which in one form or another the application of heating or cooling agents to certain parts of the body constitutes the most effective remedy that is at the disposal of the physician and surgeon. Pain may in the majority of cases be alleviated or even entirely suppressed by the judicious application of heat or cold. Usually ice bags are used for this purpose but the patient has to endure the weight of the bag with its load of ice and ice water. Whereas in the construction here shown all the weight he carries is the small coil of tubing which is quite flexible and easily fitted to the head. The supply of ice-water is siphoned down through the tubing from an elevated reservoir and is slowly discharged into a receptacle. The rate of flow is governed by a suitable valve on the discharge pipe. The tube is of rubber wound with aluminium wire, so that it is extremely flexible and will maintain any set position. Similar cooling devices are provided for other parts of the body.



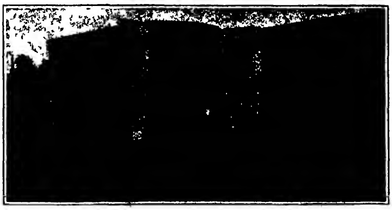
A head cooling apparatus.

Mounting a giant sunfish.

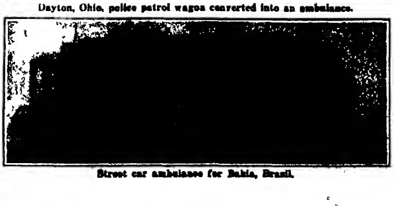
Combined Ambulance and Patrol Wagon

THE city of Dayton, O., which, like several other large cities in the United States where the manufacture of automobiles centers, rapidly is replacing horse-drawn municipal vehicles with more modern and more efficient automobiles, recently has taken delivery of an unusual type of combined ambulance and patrol wagon which has several interesting constructional features. It is shown by the accompanying illustration, the photograph having been taken during a demonstration of the vehicle's adaptability to the city's needs.

When the vehicle is used as a patrol wagon the light canvas stretchers which serve for ambulance service are carried on large hooks up near the roof—one of them can be seen in the picture. Otherwise, which means when they are in use to convey injured persons to the hospital, they are carried in spring supports, the center ones folding down out of the way when the side seats are folded up for the sterner duty of the police force. As it often is necessary for the surgeon to get at the head of his patients as they lie in the stretchers, a forward side entrance is provided. As a patrol wagon, the capacity of the vehicle is a "squad," or eight men, not counting the driver's seat and the one beside it. When occasion demands, the seats on only one side can be let down and one of the stretchers placed in position on its spring supports.



Dayton, Ohio, police patrol wagon converted into an ambulance.



Street car ambulance for Bahia, Brazil.

Conduits for the Hydro-electric Plant at Gatun Dam

THE Panama Canal is to be electrically operated and lighted throughout by power which will be generated at a hydro-electric plant located at the spillway to the Gatun Dam. At present two steam-electric stations exist, one at Gatun and the other at Miraflores, each consisting of three 1,500 K.V.A., 3-phase, 25-cycle, 200-volt steam turbo-driven generators. The power station at Miraflores will be retained permanently as a substitute or auxiliary station in case of breakdown or other emergency, but a new power station now being built at Gatun will be of sufficient capacity to furnish the necessary power for the whole canal. The hydraulic plant will consist of three 2,500 K.V.A. 3-phase 25-cycle 220-volt water-wheel driven units with sufficient provision for three additional units. The power will be utilized in the operation of the electric towing locomotives which will haul ships through the various locks, operating the lock gates, and lighting the whole canal. Ultimately, part of the power of this plant will be used for the electric operation of the Panama Canal Railroad. The illustration herewith presented shows the conduits through which the surplus waters of the lake that are turned through the plant will be conducted.

A Two Thousand-Pound Sunfish

ONE of the largest and most astonishing marine wonders seen for some time has recently been brought to light from ocean depths. This is a remarkable specimen of a giant sunfish shown in the accompanying photograph. This huge monster measures 10½ feet from tip to tip of his fins and is 9 feet long. It weighs nearly 2,000 pounds. The great fish was captured in the Pacific Ocean off the California coast and the skin has just been mounted in New York for museum exhibition. The tremendous size of this denizen of the deep can be seen from the figure of the man standing near the head. Such huge monsters are rare, however, though some weighing from five hundred to eight hundred pounds have been obtained occasionally. They are to be seen in tropical and temperate seas, both in America and other countries. While inhabiting the open sea, at great depths, they are frequently to be seen off the California and Florida coasts. The skin has a brilliant silvery appearance and at night is said to be highly phosphorescent. The flesh, however, is not used for food. The big fish has comparatively a small mouth, and to provide for the enormous stomach consumes thousands of small fish and various other marine creatures. The great fins are three feet long, and when swimming the upper one protrudes high out of the water. From certain ridges and folds developed on the body it is thought the monster is about fifty years old. One of the striking features, next to the colossal size, is the peculiar shape of the body, which looks as if the hind portion had been bitten off by some other formidable ocean inhabitant and left only a fringe of a tail.

Street Car Ambulance

AMBULANCES of all kinds and descriptions have been in use for many years past, but not until the present time has there been manufactured a conveyance for the transportation of hospital pa-

(Concluded on page 324.)

Inventions New and Interesting

Simple Patent Law; Patent Office News, Notes on Trademarks

Preparing for the Post-fuel Age

ALTHOUGH coal was mined in New Castle as early as the thirteenth century, it is only during the past hundred years or so that any very heavy drain has been made on our fuel stores, and already despite the shortness of the period we have found that they are not limitless, but are fast being exhausted. No matter how economical we may be all our coal stores will eventually be consumed, and then we shall have to return to the powers in use long before the steam age. Already we are making extensive use of water power or "white coal" as it is called, and determined efforts are being made to produce electrical energy from wind power. The tide has yielded us some power and so have the waves, and a considerable measure of success has attended the experiments with the production of power directly from the sun which, by the way, is the source of the power in our coal, our rivers, the wind, the waves, and to a large extent the tide.

It is interesting to see what inventors have been doing toward the engines of the future. Herewith are a few typical cases picked out at random from hundreds of patents. We have selected no water power engine or motor for the reason that hydraulic power may be considered well past the experimental stage. One would suppose that wind power would also be in this class. Quite apart from the problem of storing the energy there has been much inventive activity in the design of the wind wheel itself. One of the principal objects appears to be to provide automatic means for reefing the wind wheel sails so as to prevent wrecking of the machine in a storm. Another object is to design the wheel so that it does not have to turn or swing into the wind but will operate with equal efficiency with the wind blowing upon it from any direction although the wheel itself revolves on a fixed axis. Such a wind wheel is shown in Fig. 1. The wheel is in the form of a vertical drum so that it will be revolved by wind from any point of the compass. To assist the vertical drum a pair of turbines are mounted on a horizontal axis above the main drum, and these are connected with a vane in the usual way to bring them into the wind. Fig. 2 shows a very ambitious design. The wind wheel is of mammoth size and provided with a huge disk vane to direct it into the wind. The entire structure is mounted to rotate on a turntable.

The motor shown in Fig. 3 is adapted to be operated by the tide. It will be observed that as the float is lifted from the position shown in full line to that shown by dotted lines, a pair of toothed sectors will be moved in opposite directions as indicated by the arrows and acting upon pinions will transmit power to a power shaft. In considering this invention it is well to refer to a problem sometimes given to first year men in Stevens Institute. The problem is to figure out the amount of work done by the tide in raising a giant ocean liner from ebb to flood tide. Take a huge vessel say nine hundred feet long and ninety five feet beam, weighing 50,000 tons. In New York the tide rises about four and one half feet. One might suppose that it would take an enormous power to raise such a craft as this. But one is apt to overlook the time element. It takes the tide six hours to do the work, so that it actually exerts less than 38 horse-power.

"Inventors are apt to forget the amount of surface the float must cover in order to give them a power that is commercially worth while. And yet it is possible to use the tide commercially; in fact it has been used for a long time in certain favorable locations. The prime requisite is a large reservoir into which the rising tide can flow and a narrow passage for the water. Power may then be obtained from current wheels placed in the stream of water. Fig. 4 illustrates a tide mill located in such a favorable position. On one side of the mill is the reservoir, on the other the open water. Owing to the difference of level on opposite sides of the mill, the water will flow in the direction of the arrow against an undershot wheel, thus producing rotary motion. Gates are operated to reverse the conditions when the tide turns. The water will then flow in the opposite direction and operate a second undershot wheel. Of course with a system of this sort there must be long periods when no power is generated because there is practically no difference of head in the water on opposite sides of the mill. The tide motor has the advantage that it can be placed in a protected bay and hence is not subject to destruction by storm as are the ordinary wave motors.

Fig. 5 shows a wave motor which may be anchored out at sea and which will communicate power by electric cables to land. It consists of a series of floats connected by rocking arms. The heaving of the waves causes the floats to move up and down with respect to one another, rocking the arms to which pump pistons are connected, and so as the floats are rocked the pistons operate to pump water or air into a reservoir. If the reservoir is filled with air it may by means of a compressed air motor drive a dynamo which will generate current that may be sent to land through a cable, where the power may be utilized in any desired way.

Most of the wave motors, so called, are really surf motors, that is, they depend upon an actual horizontal travel of the water. Quite an elaborate surf motor is shown in Fig. 6. It consists of a series of paddle wheels mounted on floats so that they will rise and fall with the waves and keep the paddles constantly submerged to a predetermined depth. Then as the waves rush back and forth they will cause the paddle wheels to revolve, producing rotary motion which is communicated through suitable gearing to air pumps. Another type of surf motor is shown in Fig. 7. It consists of a series of large vanes or plates mounted on a low broad wheeled vehicle and arranged to be driven by the surf up the beach. Cables are attached to the vehicle connecting it with suitable mechanism on land. One of the cables, however, passes around a pulley anchored out in the water. When the vehicle is driven up the beach it raises a weight which assists in carrying the vehicle back with the receding waves. This reciprocating motion of the vehicle operates an air pump that stores the energy in a compressed air reservoir.

Another scheme for utilizing the power of the surf is shown in Fig. 8. It is adapted to be built along a rocky coast. It consists of a many-celled concrete structure firmly anchored in the rocks. As the waves dash into the open cells they compress the air contained therein and force it through pipes to a reservoir. Automatic valves on the pipes prevent the return of the air from the reservoir into the cells.

Although the heat of the sun has been utilized to raise water to the boiling point and operate low pressure steam engines some inventors have thought it better to utilize a fluid that is more readily vaporized than is water. The apparatus shown in Fig. 9 employs an ammoniacal solution which is vaporized by the heat of the sun beating upon the roof of a building. This vapor is automatically condensed by means of cold water after passing through the engine and then is returned to the roof to be vaporized again. Thus a closed cycle is maintained converting the heat of the sun into power. A similar apparatus for utilizing solar heat is shown in Fig. 10. Instead of applying the heat of the sun directly upon motor fluid it is concentrated by a reflector upon a body of water which will be suitably heated, thereby filling a reservoir with water warm enough to vaporize the fluid used in the pump or motor system. This apparatus employs in addition to the solar water heater, a furnace which may be used on dull and cloudy days when the

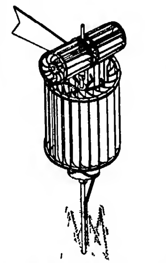


Fig. 1.—Wind wheel that turns on a vertical axis.

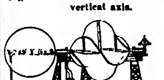


Fig. 2.—Mammoth wind motor mounted on a turntable.

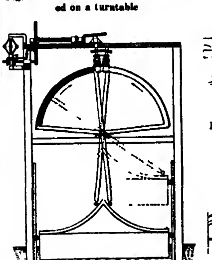


Fig. 3.—The tide slowly rotates the sector driving the power shaft.

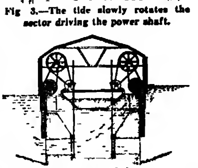


Fig. 4.—Mill operated by a stream from a tidal reservoir

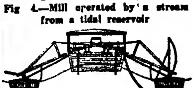


Fig. 5.—Wave motor operated by oscillating floats.

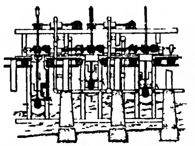


Fig. 6.—Paddle wheels propelled by the surf

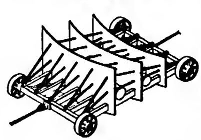


Fig. 7.—A "surf wagon" that operates a compressed air system

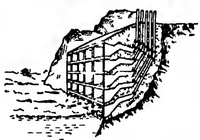


Fig. 8.—Surf dashing into the cells drives compressed air into a reservoir

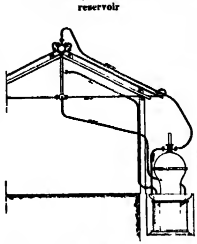


Fig. 9.—Utilizing a sun-backed roof to generate power

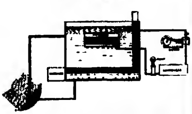


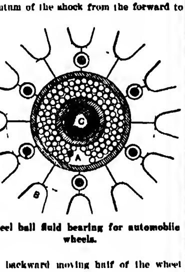
Fig. 10.—Combined sun and fuel heated boiler for an ammonia engine.

solar rays do not yield sufficient energy to operate the apparatus. In this system as in the one just described a suitable condenser is required to restore the motive fluid to liquid form after which it is pumped back into the vaporizer to be converted into a gas that will operate on the motor

Shock-absorbing Hub

FOR over two years motor buses have been in use in London which run on leather tired wheels, and the vehicles are said actually to run with less vibration than pneumatically tired omnibuses

The secret lies not in the tire, although it is of novel form being made of hydraulically compressed specially tanned leather but in the hub which is so designed as to dissipate the shocks before they reach the axle The hub is shown in the accompanying cross-sectional view It will be observed that an annular space between the shaft and the hub cylinder is filled with steel balls each about ⅝ inch in diameter These balls go around the shaft and support it They do not quite fill the annular space but leave a gap such as indicated at A under the axle C The balls arrange themselves in an arch across this gap A road shock passing up one of the spokes B, of the wheel cannot reach the axle, because of the row of balls D intervening. The entire row is forced across the gap A, carrying the momentum of the shock from the forward to



Steel ball fluid bearing for automobile wheels.

the backward moving half of the wheel The shock is then communicated to the steel balls above which slip and slide upon each other and revolve on their axes, distributing the shock just as a liquid would In fact the filling about the axle may actually be considered a steel ball liquid so far as its operation is concerned but with the advantage that the steel balls are slightly elastic

The inventor of this shock absorbing hub is John Muir The hub has proven very satisfactory, and the use of solid leather tires, which it permits, has resulted in material saving over the previous use of pneumatic rubber tires.

A Comparison of Patent Office Salaries.—The salaries paid the officials of our Patent Office suffer when contrasted with those paid by Great Britain, for notwithstanding the much higher cost of living in Washington over that in London the salaries are much lower than abroad Our Commissioner receives $5,000 per year while the British Comptroller enjoys an income of $7,500 or 50 per cent more Here the Assistant Commissioner receives $4,500 while in England the chief examiner receives $6 000 Our chief clerk has a salary of $3 000 while the British chief clerk has a salary of $5 000 per year We have three Examiners in Chief at $4 000 each while the four supervising British examiners have a salary of $4 100 each Our forty-three principal examiners have $2 700 per annum while $3,400 is paid each of the thirty principal examiners of the English office While our Examiner of trade-mark has a salary of $2 700 that of the registrar of trade-marks in the British Office is $5,500 or more than double the amount paid the corresponding official here

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Electrical Devices.

SWITCH AND RECEPTACLE BOX.—R. ROSEVEARNS 201 Third Ave., Manhattan, N Y N Y This invention has reference to a switch and receptacle box designed to be supported in a recess in the wall or ceiling of a building and having openings in the side closed by plates which receive and secure the ends of the cables or other conductors with which the building is wired.

Of Interest to Farmers.

WING CARRIER.—W F BROWN, 5207 Penn Ave So, Minneapolis, Minn. The carrier employs troughs and conveyer means mounted therein and moved lengthwise thereof for impelling the material deposited in the trough to the delivery end thereof In the construction the sides of the trough are disposed at various angles to contract or expand the carrier Means provide for raising and lowering the delivery end of the trough

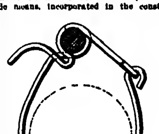
AUTOMOBILE CULTIVATOR WITH ROTATIVELY DRIVEN CULTIVATING DISKS —M LANDRIN Place Mantoue Soissons, Aisne, France The cultivator frame is connected to the tractor frame by a universal pivot device in order to allow the tractor to oscillate in accordance with the irregularities of the ground without affecting the working position of the cultivator frame The shaft carrying the cultivator disks is adjustable in direction in relation to the line of travel.

Of General Interest

STAIR TREAD ANCHOR.—H H VERITY 1441 Chester Ave Ozone Park L. I., N Y., and J HANSON Corona, Queens, N Y, N Y This invention relates to concrete stairways, and its object is to provide a new and improved stair tread anchor adapted to be embedded in the concrete steps, and arranged to allow of conveniently and securely fastening the stair treads in position or removing the same in case one is worn out.

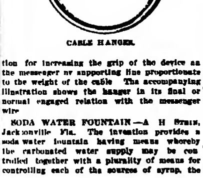
FOUNTAIN PEN.—G W HEATH 232 Second St Newark, N J An object here is to eliminate the possibility of accidentally collapsing the reservoir tube and at the same time to provide a construction in which the presser bar is raised out of engagement with the flexible reservoir before the device can be set in its normal position and which is positively locked in this raised position

CABLE HANGER.—C LINGLE, Clinton, Mo Among the principal objects which the present invention has in view are to provide a simple and efficient device to facilitate the hanging of electrical and other cables, and to provide means, incorporated in the construc-


CABLE HANGER.

tion for increasing the grip of the device on the messenger or supporting line proportionate to the weight of the cable The accompanying illustration shows the hanger in its final or normal engaged relation with the messenger wire

SODA WATER FOUNTAIN.—A H STEIN, Jacksonville Fla. The invention provides a soda water fountain having means whereby the carbonated water supply may be controlled together with a plurality of means for controlling each of the sources of syrup, the


SODA WATER FOUNTAIN

construction and arrangement being such that the carbonated water may be supplied in a fine stream at the same time that the syrup is supplied, thereby mixing these substances within the glass or in supplying the syrup with the carbonated water in a heavy stream

Hardware and Tools.

MONKEY WRENCH.—J KRAKULAC, Lock Box 134, Braidwood, Ill. In the present patent the invention is an improvement in that class of monkey wrenches which are provided with a slidable jaw and a toothed dog adapted


MONKEY WRENCH

to engage a toothed portion of the wrench shank for locking the said jaw in any desired adjustment relative to the fixed jaw The improvement is adapted to serve as an ordinary monkey wrench or as a pipe wrench, as occasion requires.

Heating and Lighting.

FLUE SECTION.—W D IVES, 244 York St., Jersey City, N J and J NOVAK, N Y., N Y This invention provides a section having heating pockets for admission of air to the fire-pot of a furnace provides a section constructed and arranged in knock-down form, adapted to be varied in size to suit exigencies of installation provides means adjustable in conjunction with a flue damper for varying the proportion of fresh air admitted, and provides air-ducts the length of which may be varied to suit the exigencies of installation

Household Utilities.

PORTABLE RECEPTACLE OR CONTAINER.—R. NADEAU Presque Isle Maine This improvement pertains to containers, and more particularly for embodiment in a coal scuttle or hod The object of the invention is to provide a container that can be easily and readily filled without the use of a shovel by forcing the mouth and neck of the container into a pile of material

FLY KILLER.—E L GAIMES and F PETERSON Red Cloud Neb Among the objects aimed at in this invention are the following, to provide a poisoning device that is simple in construction and operation cheap to install and use and which may be disposed out of the way of children or household pets, and to provide a device which is certain in its operation to destroy the flies.

Machines and Mechanical Devices.

ENGINE STARTER.—G J SPOHRER, care of Wilson Motor Starter Co Franklin Pa This invention relates to an engine starter and an object of the inventor is to provide a form of device in which a fluid actuating element is positively brought into engagement with the engine mechanism after a back firing action on the part of the latter

CURRENT MOTOR.—J H MARTIN 615 W Lynne St Springfield Mo. This invention provides a motor of an improved form of vane which will automatically take a position at right angles to the direction of movement of the current when the vane is in the water and a position parallel with the direction of movement of the vane when out of the water and wherein the change in position of the vane is caused by action of the water and wherein no extraneous mechanism is necessary for making the change in position

MECHANICAL MOVEMENT.—J W PITTS, 3835 Tenth St., N W Washington, D C An object here is to provide a device whereby a reciprocatory motion may be converted into a rotary motion or vice versa A mechanical movement is provided in which there is less loss of power in the conversion of one motion into another and into the ordinary mechanical movements.

AUTOMATIC HOSE AND FABRIC CUTTING ATTACHMENT FOR KNITTING MACHINES.—T RYAN care of the Simons & Strauve Hosiery Frankford, Philadelphia, Pa. In this invention the attachment comprises cutting mechanism, preferably in the form of scissors or shears, which is automatically operated to sever rib hose or other fabric as produced by a knitting machine, thus dividing the product into desired lengths or sections.

VALVE CONTROLLING MECHANISM.—J L EDLAND, Bloomfield, N J, care of H J Koehler 33 So. Munn Ave., East Orange, N J This invention relates to certain improvements in valve-controlling mechanism, and the purpose of the improvement is to so control a plurality of valves that they may operate independently, yet in their operation will permit the passage of equal amounts of fluid.

ALARM BANK.—C. SAYERS, 131 Lexington Ave., Jersey City N J The invention is an alarm bank adapted to be secured upon a shelf or other support by a suitable fastening device such as a bolt or screw. The fastening device is connected to mechanism on the inside of the bank casing by means of which an alarm will be sounded when the bank is removed from its proper place, the fastening device exerting a tension on the alarm mechanism and actuating the same to produce the effect.

SORTING MACHINE.—C. W NARAMOR, Mecosta, Mich. This invention relates generally to sorting machines and more particularly it is directed to one particularly adapted to sort beans. The principal object is to provide a new means of adjustably mounting disks on a rotatable shaft, the construction being particularly adapted for use in bean sorting machines.

BAND MILL LINING DEVICE.—J, E. WHITWORTH, L. B. 90, Jeanerette, La. This invention relates to means or appliances for setting band mills or the like in sawmills and has particular reference to an implement comprising a frame or support track and also including a plumb line which is adapted to cooperate in the setting of the mill with one or both of the band wheel shafts.

DEVICE FOR AFFIXING AND PRINTING ON LABELS.—S. BYLICKI and J PARENSKI, Kracow Austria Hungary The labels, stamps or the like form a continuous strip, which is wound into a roll or zigzag folded. By a single operation of a handle the foremost label or stamp already separated from the rest is fed forward moistened or coated with a suitable adhesive, affixed and provided with an impression at a predetermined point and the next label or stamp is drawn forward and separated from the rest so that the device is ready for the next operation

Prime Movers and Their Accessories.

ENGINE VALVE.—W JOHNSON P O Box 32, University Place, Neb. The object of the invention is an improvement in rotary and oscillating engine valves air compressor valves, ammonia compressor valves, throttle valves, cut-off valves, admission and releasing valves. A casing and cone valves are employed having diametrically opposite ports, gearing for rotating the valves in a particular manner and boxing adapted to adjust the valves endwise.

Railways and Their Accessories.

CAR VENTILATOR.—W L WALSH, 424 E. 157th St New York, N Y This invention provides a flue from which the air may be drawn by operation of the train and devices to govern the communication between the interior of the car and the flue, provides auxiliary boxes having communication with the interior through controlled passages, the air in the chambers being exhausted by the travel of the car provides means operable from within the car for varying the disposition of the draft members of the ventilator and provides draft members for flue and boxes extended beyond the influence of eddying currents formed by the movement of the car body

Pertaining to Recreation.

GAME APPARATUS.—J B FORTNAM, 1465 Bushwick Ave Brooklyn, N Y This invention provides a game apparatus with which may be played several interesting games, the game apparatus consisting of a board with a group of forty-one hexagonal spaces, there being a star in the space in the center of the board and marks to indicate the castles which are spaced apart on each side of the board

Pertaining to Vehicles.

BICYCLE PUMP E H WRIGHT Box 355, St Helena Cal This invention has reference to improvements in bicycle pumps, and has for an object to provide an improved pump and supporting devices adapted to hold the pump for fitting in a proper position on the bicycle frame for ready operation at all times.

Designs.

DESIGN FOR A MEMBER OF A PAIR OF SHEARS.—W M HOWES, 127 Duane St., New York N Y In this ornamental design for a member of a pair of shears, the member presents a graceful design in which some of the usual round features are outlined by angles.

DESIGN FOR A DISH.—M HASSETT 26 Murray St., New York, N Y In this ornamental design for a dish the designer shows a cut-glass dish in the form of an automobile.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

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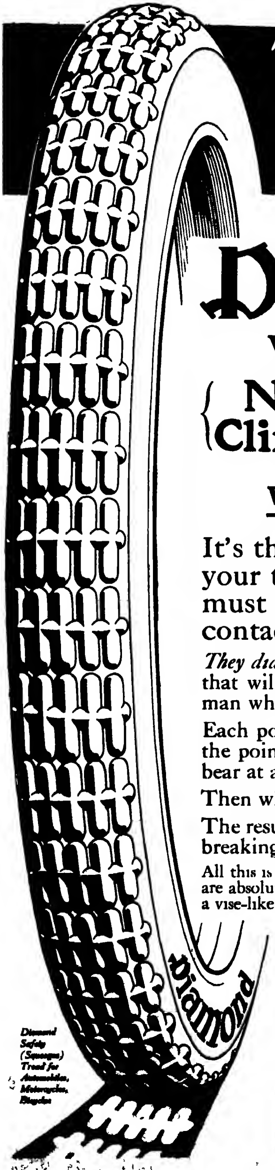

Tire bill payers!

You have demanded a vise-like rim-grip - with no cutting or breaking above the rim - and here it is

Diamond

Vitalized Rubber

{No Clinch} Tires

Cross Section Diamond Safety Tread Tire

with Perfect 3-Point Rim Contact

It's the *rim* as much as the *road* that wears out your tires. So we said to our engineers: "You must build us a tire with perfect 3-point rim contact."

They did—and now we offer you a sane, sensible, No-Clinch tire that will appeal to you, as a hard-headed, shrewd tire buyer—a man who insists on easy riding comfort and good liberal mileage.

Each point of rim contact in a tire is a point of support. Where the points of contact are not perfect, undue pressure is brought to bear at an unsupported point of the tire.

Then what happens?

The result is a terrific strain on the tire that will cause rim troubles, breaking above the bead and separation of the tread from the carcass.

All this is overcome in the "Diamond" because the three points of rim contact are absolutely *mechanically perfect*—the annealed steel cabled wire bead holds with a vise-like rim-grip.

This is only one Diamond advantage.

You get additional More Mileage without extra expense in the Diamond *Vitalized Rubber*—a scientific combination of pure, lusty, young rubber and a secret toughening compound—nothing inferior in rubber, fabric or workmanship—the No-Pinch Safety Flap inner tube protector—and, if you desire, the now famous Safety (Squeegee) Tread.

Diamond Safety (Squeegee) Tread for Automobiles, Motorcycles, Bicycles

So this time buy Diamond Vitalized Rubber Tires—you can get them to fit your rims at any of the

25,000 Diamond Dealers
always at your Service

The guarantee on Diamond Tires becomes null and void when the tire is used in connection with any substitute for air filled to rims not bearing one of these inspection ... damage or having had its serial number removed in whole or part

Notes for Inventors

Timer for Electric Welding Machines.—John Allen Heany of Washington, D. C., in patent, No 1,050,827, describes an electric welding machine, which embodies a transformer and electrodes and means automatically operated from the line circuit for stopping the welding action at a predetermined time so that the period of welding operation may be controlled

Parcel Post Improvement.—The inauguration of the parcel post service promises to lead to various improvements in equipment and accessories, racks in receiving and delivering stations and in the cars, packages or cartons especially adapted for the receipt of the commodities, and ready reckoners for rates and the improvements will no doubt lead in many other directions as the ingenuity of the inventive class is brought to bear upon the demands of the service

An Edison Phonograph Patent.—Thomas A Edison, assignor to Thomas A Edison, Incorporated, has patented, No 1,050,355, a phonograph in which the sound-conveying horn is directed forwardly from a reproducer in approximately a horizontal direction, the chambers containing the horn and reproducer being separated and the motor being located below the reproducer chamber. The structure is of a pleasing appearance and permits the suspension of the sound-conveying means in a horizontal position so that the loss of volume due to bends in the horn is prevented while at the same time the advantages of the concealed horn are retained

Timber-cutting Method.—Patent, No 1,050,768, for method of severing timber, has issued to Hugo Gante of Berlin, Germany, for a method in which one or more wires are reciprocated against a timber producing the heat necessary for the carbonization of the timber in front of the wire, the wire being preferably provided with projections to aid in producing the heat. The patent distinguishes from the known method of severing timber by means of specially heated wires as in the improved method there is used solely the heat which results from the friction between the wire and the timber, the toothed or roughened feature of the wire aiding in scraping away the resulting carbon

A New Gold-leaf Process.—What is said to be a new process for the manufacture of gold leaf has been introduced by a London firm. In carrying out the process, a ring of aluminium about 5 feet in diameter and 5½ inches wide is coated with a solution of gum and after drying is dusted with some metallic powder in a thin layer. After this layer has been polished an electro deposit of nickel is made upon the polished layer of baser metal and gold is then electro deposited on the nickel. Each of the four layers is very thin and the composite layer is said to be thinner than the ordinary gold leaf. When the formation of the leaf has been completed, the film is cut to expose the soluble base layer of gum and the ring is immersed in a solvent liquid which dissolves the gum and the metal film falls onto a band moving at the same rate as the ring which last is rotated in the dissolving liquid, the film and paper being finally cut into book size

Metal-treating Machines.—Three patents, Nos. 1,050,878, 1,050,879 and 1,050,880, have issued to Frank L. O Wadsworth of Sewickley, Pa., the first for treating metal, the second for densifying metal and the third for uniting metals. The first patent is for a method of treating metal in which the metal is rolled longitudinally and its fibers are simultaneously subjected throughout the entire width of the metal to a progressive continuous displacement in the same direction at an angle oblique to the direction of rolling, this being effected by fine corrugations in the rolls. The patent, No 1,050,879, is for densifying the metal, while the patent, No. 1,050,880, is for a process of uniting different metals in which a body of one of the metals is heated and there is mechanically kneaded into the surface of the heated body a finely divided substance of a nature to facilitate welding and the other metal is then welded upon the prepared surface.

INQUIRIES

Inquiry No. 9360. [illegible]

Inquiry No. 9361. [illegible]

Inquiry No. [illegible]

Legal Notes

Court of Appeals Decisions.—Out of sixteen patent appeals in which decisions were handed down by the Court of Appeals for the District of Columbia on December 30th, 1912, the decision of the Commissioner of Patents was reversed in only two cases. In one of these, that of Perri against Thoma, the decision of the Commissioner was reversed, and priority as to all counts awarded Perri. The other case in which the Commissioner's decision was reversed is that of Broune v. Dyson, in which priority was awarded to Broune.

Some Adjudicated Patents.—Patent No. 709,716 for a dumping wagon has been held void for lack of patentable invention in Leonhardt v. Lynch, 199 F., 700, while the Bronnenkant patent No. 739,824 for a bunion protector has been held valid and infringed in Fisher Manufacturing Company v. Lawrence, 199 F., 799. The Towne patent No. 848,140 for a steering wheel for auto vehicles has been held void on its face for lack of invention in Towne Steering Wheel Company v. Leo, 199 F., 777, the Jordan patent No. 892,068 for apartment wall furniture has been held not infringed in Marshall & Stearns Company v. Murphy Manufacturing Company, 199 F., 772, and the Andrews patent No. 897,513 for a toaster has been held valid and infringed in Andrews Wire & Iron Works v. Wilson Manufacturing Company, 199 F., 798.

Some Adjudicated Patents.—In A. R. Mosler & Co. v. Lurie, 20 Fed. Rep., 433, it has been held that the Canfield patent, No. 612,701, for an igniter for gas, oil or vapor engines, is valid but not infringed, in Theo. J. Ely Manufacturing Company v. Fritsch, 200 Fed. Rep., 424, it has been held that the Hoffman patent, No. 671,136, for a mop wringer, is valid and infringed, the Latham patent, No. 707,934, for a projecting kinetoscope, has been construed and held not infringed in Motion Pictures Patents Company v. Independent Moving Pictures Company of America, 200 Fed. Rep., 411, it has been held in Ruud Manufacturing Company v. Pittsburgh Water Heater Company, 200 Fed. Rep., 440, that the Ruud patent, No. 761,409, for a gas burner, was construed and held not infringed and that the Ruud patent, No. 875,218, for a gas burner, was void for invention and that the Ruud patent, No. 903,007, for a water heater, was held valid and infringed, and in Williams Patent Crusher and Pulverizer Company v. Kinsey Manufacturing Company, 200 Fed. Rep., 441, it has been held that the Williams patent, No. 939,775, for an improvement in pulverizers, is not void on its face for lack of invention.

Court Decides Against the Taggart Dental Inlay Patent.—Much interest is taken by dentists in the decision of the Court of Appeals of the District of Columbia voiding the Taggart patent, No. 872,978, of December 3rd, 1907, upon a divisional application filed July 13th, 1907, of original application filed January 12th, 1907. This decision, the opinion in which was rendered by Mr. Justice Robb, reverses the decision of the Supreme Court of the District of Columbia, which decision sustained the Taggart patent. Defense was made that the invention had prior to Dr. Taggart's invention been taught, used and operated, at least two years before the filing of the Taggart application for patent. The Court said that it was fully persuaded that the evidence shows beyond a reasonable doubt that for many years prior to the filing of the application for patent the process of making patterns and molds for dental inlays and the like, as expressed in the claims, had been publicly practiced upon many occasions and that it was of no possible consequence that by the use of Dr. Taggart's machine, gold inlays and the like might be produced more cheaply and rapidly than they were produced by dentists who had testified in the case. The Court goes on to say that the art of producing metal castings by means of a mold formed of a wax pattern is very old, was practiced by the ancient Greeks and Romans, extensively used in the middle ages for producing statuary and is known as the "cire perdu" or "lost wax" process.

Trade-mark Notes

A Trade-mark Decision.—In the case of *ex parte* United Roofing and Manufacturing Company Mr Commissioner Moore has decided that the word "Lakeside" was held improperly and refused registration on the ground that it is a geographical term In his decision the Commissioner called attention to the fact that there are sixteen or seventeen post offices in the United States called Lakeside, but none of these are well known places and the Commissioner says that he cannot agree with the holding of the examiner that it is probable that an ordinary person would regard Lakeside as a geographical term but believes that the word would be regarded as fanciful by a large majority of observers and therefore decides the mark to be registrable

Trade-mark Oppositions.—In The Irish Industrial Development Association v Barrett, the Commissioner of Patents following a number of cases, such as Lang v Green River Distilling Company, Natural Food Company v Williams, and Johns-Manville Company v American Steam Packing Company, has held that it is not necessary in order to sustain an opposition that it should appear that the opposer is entitled to register the mark, but that it is sufficient that the mark should have been used in some manner analogous to trade-mark use and that the opposer has such an interest therein that he would sustain or be likely to sustain actual damage by the registration of the trade-mark by another

Copying a Trade-mark in China.—The Shanghai *Daily News* tells how, at the mixed court in Shanghai, which has jurisdiction over Chinese residents, a Chinaman, Tai Yuin-tsen, was charged with selling goods to which a false trade-mark had been applied, the false trade description being that certain boxes containing soap manufactured and sold by the Chang Sing Woo Ku Company (Limited) bore the name and stamp in English of soap manufactured by W Gossage, for which Mr C R Burkill is the local agent Mr Burkill stated that he saw the boxes of soap on a barrow, and recognizing the trade-mark had the man detained by the police His firm were the sole agents for the manufacturers. A stencil of the trade-mark was found in the factory, and there were 214 boxes of soap there bearing the trade-mark The defendant was fined $100, and the court ordered that the boxes already stamped with the stencils, be confiscated Had we some such summary punishment for trade-mark infringement, in this country, there would be less trade-mark piracy

A Peculiar Trade-mark Condition.—In a recent decision by the Commissioner of Patents, it appeared that a registration certificate was issued in 1908 to "The American Rolling Mill Co of Middletown, Ohio a corporation organized under the laws of the State of Ohio" upon an application purporting to be filed by such company Later application was made "The American Rolling Mill Company" for the cancellation of the registration, which application stated that the registrant company is a corporation organized under the laws of the State of New Jersey and under the laws of no other State and that the statement that the company was organized under the laws of Ohio was an error due to accident, inadvertence and mistake. After due proceedings an order was duly entered by the Commissioner of Patents canceling the registration An application was filed by "The American Rolling Mill Company, a corporation duly organized under the laws of the State of New Jersey and located and doing business in Middletown, Butler County, Ohio," for the registration of the same mark and the Examiner of Trade marks has refused registration on the last application in view of several registrations. The petitioner then sought to have the original registration reinstated. In denying such petition, the Commissioner suggests that it does not appear that the petition could obtain any legitimate benefit from such a registration, that it is believed the Comissioner had ample warrant for canceling the registration but that he has no authority to reinstate said registration to a non-existing corporation.

Achievements of Military Aircraft

(Concluded from page 307)

observers, in aeroplanes, wears them out very quickly Rain and snow will seriously affect the lifting power of the dirigible and may bring it to earth as was the case with the Parseval II, which was compelled by a rain storm to descend during the German maneuvers in 1910 when scouting for the Red side and was captured by Blue The comparative slowness, bulk and vulnerability of the dirigible have given rise to the supposition that it will fall an easy victim to the aeroplane but the increasing speed and lifting power of such large vessels as the latest Zeppelins, and the fact that they are better suited as a platform for machine or pneumatic guns, and can rise quicker by using their planes and vertically by casting out ballast, while the aeroplane can ascend only at an angle and in spirals, seems to imply that the odds are not so greatly in favor of the aeroplane being able to get immediately over the airship and rain down missiles and explosives without risk to itself Special aeroplanes to be armed with machine guns, are being built in England for the express purpose of attacking airships, and there is no doubt that a combined attack by a number of these with their concentrated fire from several directions, would be difficult to deal with. Even in this case however we must remember the rigid type of dirigible built in many gas-tight compartments could safely stand the piercing of some of these by splinters, or even the evacuation of one or two sections, if provided with sufficient margin of lifting power and ballast Beyond the chance of injury to some of the mechanism or the crew the dirigible has little to fear from machine guns firing ordinary small arm ammunition the leakage of gas from bullet holes in the envelope being comparatively negligible Although appearing to offer a huge target in the day time, it will usually travel at such a height and pace and be able to change direction and altitude so easily in order to prevent artillery from getting the range with incendiary projectiles besides taking possible advantage of clouds as cover from view that it will not necessarily be an easy mark for the gunner The sighting of guns at high elevation is a difficult matter with the range altering rapidly all the time A well known artillery officer who has made a study of the subject, has gone so far as to say that at a height of 4,000 feet it is impossible to hit aircraft by fire from guns on the ground By night an airship is almost invisible It has been found difficult to distinguish even in clear weather and when look outs have been warned and search lights used

Harnessing the Public Water Power

(Concluded from page 311)

Dam. Some of the surplus is leased to light the town of Fallon.

Unique Development of Power.

One of the unique water power plants is on the Huntley project where a drop in the canal is utilized in pumping a portion of the water to a higher level than the gravity canal and where the power and pumping units are combined. In this case, which reminds us of lifting one's self by the boot straps, the falling water operates a turbine wheel connected directly with a centrifugal pump The entire operation is simple and automatic and requires only such attention as will prevent the entrance of trash and the regulation of the amount of water About 4,000 acres are thus supplied.

A similar plant is being installed on the Lower Yellowstone project in Montana to reach 3,000 acres of high land.

On the Yakima project the irrigation of considerable areas of high land is accomplished by means of a battery of hydraulic rams which for these relatively small installations are probably the simplest and most economical device yet employed.

Unique Development of Power.

One of the most unusual power plants is located at Williston, North Dakota. Here the Reclamation Service is operating a large coal mine, delivering the lignite to a nearby power plant, where power is generated and transmitted to the Missouri River near Williston, about six miles, and Buford, 24 miles distant. At these points are floating barges upon which are set the large pumps operated electrically. The barges are attached to the bank by flexible pipes capable of being extended or shortened to meet the shifting of the stream channel. In winter these barges are hauled up on the bank out of the way of ice damage.

The Street Car Ambulance

(Concluded from page 316.)

tients over the street car tracks of any city. The ambulance was built for a street car company in Brazil and will operate to and from the outlying hospitals in the city of Bahia, access to which cannot be readily reached by the ordinary methods used in bringing patients to hospitals.

The car is divided into five compartments, providing a nurse's room just outside of each hospital room, and a fumigating compartment in the center.

The car is to be used for contagious disease patients as well as others, and for this reason the designer had to use considerable originality in order to locate the fumigation compartment so that it might be easy of access, and at the same time isolate the patient from the employees of the car. The fumigation compartment is located in the center, is not of easy access to either hospital room, and has a width of 2 feet ⅝ inch. It is hermetically sealed from the remainder of the car with the exception of a hole through each crosswise partition, through which the fumigation process takes place. This arrangement obviates the necessity of either nurse or doctor entering the hospital compartment. At either outside end of the disinfecting room is a paneled door.

The two largest compartments of the car show the hospital arrangements, each room accommodating two iron beds supplied with rubber tired rollers, springs and the regular mattresses. The outer walls of the two compartments are so arranged that they may be easily lowered to permit of receiving a patient from a stretcher. When lowered they form a continuation of the floor of the car and are held in position by means of iron supporting rods. Each compartment is sufficiently well lighted by an arrangement of double paneled wire glass windows located above each bed and frosted upon the inside.

A ventilating hole 8¼ inches in diameter is located under each bed. This is covered by a removable register into which may be deposited any air-distilling material desired.

Separating the car body proper from the platform is a steel bulkhead without openings of any kind completely isolating the crew of the car from patients suffering from extremely contagious diseases. Every precaution has been taken by the designer to prevent infection arising from such a source and to this end in place of the ordinary cord bell an electric bell is used.

Latent Pressure in Rock Strata

ALTHOUGH all underground borings such as mine galleries are subjected to the effects of the weight of overlying strata as a natural consequence, it appears to be found that the effects which are noticed in such cases are not entirely due to weight of the soil, so that other causes must be supposed, especially the action of the latent pressure coming from earth movements which may have been maintained clear up to the present time. The French scientist, Lapparent, was led to think that all the rock strata of the globe are more less compressed from mechanical movements which they underwent in the course of ages. Chief Engi-

near Morris of the Lievin mines in France made some observations on this subject. While mine tunnels were being put through, or shortly after, he noticed slow movements of the ground which cannot always be accounted for by the simple weight of overlying earth. Certain places showed an abnormal pressure at various levels under ground, and at other points he found very great pressures at small depths, and on the contrary low pressures at great depths. Considering various observations, he is led to believe in a latent pressure in rock strata

The Problem of the World's Oil Supply

Consuming the Product of Ages in a Year

IN view of the importance of the many industries which rely upon oil as fuel, the question of the possible exhaustion of the world's oil supply deserves the gravest consideration. There is every indication that we are face to face with this possibility In the oil districts themselves the cost of crude oil has so risen that in the Russian, American, Roumanian and Galician fields record prices are being obtained. It may be remembered that a short time ago a vessel endeavoring to obtain heavy oil in New York had to pay $12 a ton, which is about the price at which it can be obtained in England It may be that the present high cost of oil is partly due to financial jugglery, but on the whole there can be little doubt that it is chiefly due to a real shortage in the world's supply

Prof. Lewes, lecturing before the Royal Society of Arts in England on the subject of Liquid Fuel said that as long ago as 1886, when the Pennsylvania oil fields were in their zenith and flooding America with oil to such an extent that the barrels were of more value than the oil itself, Prof. Leslie, one of the greatest authorities on the subject, addressing the oil mining experts in Pittsburgh right in the heart of that country, put it to them in the clearest possible way that the enormous floods of oil they were getting must of necessity soon come to an end "It is clear," he said that in the laboratory of nature you can only have oil being formed at about one ten thousandth or millionth the rate at which it is being consumed, and inasmuch as the strata contain only a certain quantity of oil, the tremendous output will mean that these oil fields will only be gleaning with difficulty the dregs we have left behind" Of course considerations of this kind cannot be expected to influence in any way business men, but Prof. Leslie's words have proved to be absolutely true as regards that field, which was the first to show signs of exhaustion, and at the present moment in that district, which yielded those floods of oil, only barrels are now obtained where the yeld was hundreds of tons. The Baker Field, too is showing signs of exhaustion. The Texas Fields have been opened up, and supply is rising, and also the California Fields, these give the supplies to America As for the whole world's production, although it has been doubled within the last ten years, this result has only been obtained by the multiplication of wells not twice, but twenty fold, and by the opening up of new oil fields. But in spite of this, it would seem that the supply cannot keep pace with the demand. There is no indication that the present high prices will be lowered. They may even increase. Meanwhile the oil consumption of the world is growing at an enormous pace. Gasoline, which a quarter of a century ago was regarded almost as a waste product, is now in such great demand that in England alone, which consumes only one thirtieth of the total oil supply of the world, the consumption has doubled during the last four years, eighty million gallons having been used in 1912.

In these circumstances, therefore, the problem of finding substitutes for the kinds of oil in greatest demand becomes of the first importance, Gasoline, which is a light oil, is at present the most important, and the general oil shortage is chiefly felt as it affects the supply of gasoline. These considerations have led to the establishment of a Petrol Committee by the Royal Automobile Club, and representing practically every known motoring organization. The first report was published last summer and was devoted entirely to the subject of transport and handling generally with due consideration of the restrictions existing as to storage, and the result may be summed up in the statement that the committee arrived at the conclusion that even if the restrictions were reduced and transport cheapened, gasoline might, and probably would remain equally dear The second report published very recently, considers possible substitutes for gasoline So far it has devoted its attention to one viz., benzole Benzole as sold in the trade under the name of 90 per cent benzole consists of three pure products benzene, toluene and xylene All these are hydrocarbons but the proportions of hydrogen and carbon are different in the three compounds, and they have different boiling points and consequently different freezing points It is the lower freezing points of the toluene and xylene which are so valuable as the benzole alone that is pure benzene freezes at so high a temperature that it would be inconvenient for winter use if not altogether impossible on many occasions.

The proportions in which the three constituents are found in 90 per cent benzole are given as 70 per cent to 75 per cent benzene 24 per cent to 29 per cent toluene, and about 1 per cent xylene The term 90 per cent benzole is entirely a trade name and is no indication of the purity of the benzole It merely implies that the mixture of benzene toluene and xylene is such that 90 per cent of the mixture will distill over below 100 deg Cent Pure benzene would be disadvantageous, not only because of its tendency to freeze in winter but also because its pushing power would be less It has been found experimentally that the presence of toluene means considerably more power on the hills. There are usually a number of impurities in benzole but this can be readily obviated by giving it efficient washing

If the washing and final rectification be carefully done the quantity of impurities remaining in the benzole ought to cause no trouble whatever

The committee found that not only could benzole be used as an effective substitute for gasoline but that it was even more efficient They say With reference to the increase in mileage obtained by the use of benzole, this is only to be expected The whole question is one of calorific value per pound of fuel Assuming petrol (gasoline) to have a calorific value of 19,500 British thermal units per pound, and 90 per cent benzole to have a calorific value of 20,000 British thermal units per pound, and taking petrol (gasoline) at 7¼ pounds per gallon and benzole at 8.8 pounds per gallon, this gives benzole an advantage of 20 per cent in calorific value over petrol *per gallon*, hence the increased mileage"

As against the optimism of this part of the report we must set the facts that the present supply of benzole is so small that it stands no chance of rivaling gasoline, and that no evidence is yet available as to what are the true commercial possibilities of increasing the supply of benzole. It must not be forgotten that the production of benzole from coal involves coking about half a ton of coal to get a gallon of benzole And if benzole is to take the place of gasoline it must be produced by the millions of gallons, which means that a market must be found for the corresponding millions of tons of coke. These are questions which have yet to be investigated, and it is hoped that with the publication of the third report of the Petrol Committee we shall know exactly where we stand.

Summary of the Seventh Annual Report of the Carnegie Foundation for the Advancement of Teaching

THE seventh annual report of the president and treasurer of the Carnegie Foundation which has just appeared, covers the year ended September 30th, 1912.

The report of the president, like the former reports, is divided into two parts —the first referring to the current business of the year and dealing with questions more directly pertaining to the administration of the foundation, the second part being devoted to current educational problems of a larger and more general nature

The first part of the report includes a careful statement of the whole question of pensions for teachers, for Government employees, and for industrial employees This statement contains the results of the examination of practically all of the pension systems now in operation anywhere and leads finally to a discussion of a feasible pension system for the public school teachers of a State As the report points out the bills which have been introduced in the various legislatures almost without exception violate fundamental actuarial conditions, and have been framed without study of the essential conditions which must be fulfilled by any adequate pension system The material brought together in this report the examples of the failures of pension systems which have occurred as, for example that in New South Wales and the precarious situation in which many State pension systems now stand, make this portion of the report one of great practical value to the authorities of any State contemplating pensions either for teachers or for State employees

President Pritchett in arguing finally for some form of contributory pension system for public school teachers points out clearly the difficulties of the contributory system the necessity for the most careful actuarial advice and the public nature of the questions which are involved in a distribution of the cost of such a pension system between the State and the teacher

Following the discussion of these pensions a complete history of the methods by which the Carnegie Foundation pensions were arrived at is given The process through which the trustees worked is told in the frankest manner, the difficulties which they encountered and the differences which arose out of the fact that the pensions of the Carnegie Foundation are not contributory, but have come as the result of a free gift are made clear The literature on pensions now at the disposal of the Foundation is probably the most complete in the statement of such problems that has ever been brought together and the discussion here made cannot fail to be of value to a college, a State or an industrial association which is studying the pension problem and the pension problem to-day is one of the insistent problems of modern social progress.

The second part of the report is devoted to such subjects as the matter of college entrance requirements, admission to advanced standing a statement of medical progress, university and college financial reporting advertising as a factor in education, education and politics, and finally, sham universities

All of these subjects are discussed in the frank and specific manner which has hitherto been used in these reports. In recounting the extraordinary medical progress of the last five years attention is called to the connection which still exists in the United States between reputable colleges and unworthy medical schools. The lessons of the recent Bulletin on Medical Education in Europe are also brought clearly forward. During the last five years the mortality among unworthy medical schools has been most satisfactory The number of such schools in the United States has been reduced by about one third and the number of students attending them by about one quarter, and this diminution has occurred in exactly the places where it ought to

occur—namely in the elimination of the unfit.

The section devoted to education and politics discusses not only the recent remarkable changes in the University of Oklahoma, the University of Kentucky and the University of Montana but also deals with two other tendencies in political life which are profoundly affecting education first with the rivalry which comes from competing State institutions, and secondly with the practice inaugurated almost wholly within the last ten years in States where there are no State universities, of subsidizing institutions that are under private control In a number of States this process has gone on until it has enormously increased the number of privately controlled institutions which share in State appropriations. So marked has this tendency become that the question of State appropriation to education without State control is one which ought now to be frankly and squarely met.

Under sham universities the report deals with conditions such as hold, for example, in the District of Columbia where commercial enterprises without endowment or facilities are chartered as educational institutions under the loosest conditions which enable them to appeal to the credulity of ignorant students throughout this and other countries under high sounding names and under the shelter of charters granted by the general government A bill now before Congress aims to correct this situation

A New Study of Putrefying Bacteria

AT M Metchnikoff's laboratory at the Pasteur Institute M H Tissier is engaged in observing the action of various microbes in putrefying meat or milk, and compares the effect of different bacilli upon albuminoid matter In his late experiments he makes use of the leading meat putrefying microbes such as *B perfringens*, *B proteus vulgus* and others. As to the matter to be attacked, this is proteic matter, such as albumen from blood, eggs or plants also fibrin, caseine etc, besides foods such as lean meat white of egg milk cheese, and many other products. The tests under microbe culture in large glass bulbs lasted one month His tables show that the greatest action is given by the anaerobic bacilli as *B putrificus* and the two bacilli taken from intestinal sources the *B sporogenes* and *colicogene* The effect of the *perfringens* is less marked especially with albuminoid matter used alone but hydrocarbons put along with this will increase the action, such as sugar or starch. Of all the microbes he used only the *proteus* produced indol and the *perfringens* indol and phenol None of them formed toxic substances.

New Fibers for Textile Use

FABRICS known by the general name of vegetable silk are now being made from a number of vegetable fibers, and owing to recent researches this number is likely to increase before long The fiber known as kapok has been in use for some time as a stuffing material for life-belts mattresses and cushions, and it is now coming into use for making vegetable silk At Chemnitz, Germany, the manufacture has been going on for several years past, and the kapok fibers are first put through a chemical treatment before spinning into threads. The kapok fiber comes from the plant known as *Criba pentandra*, but it is not the only source of vegetable silk for in fact the same works is making use of the "akon" fiber, this being taken from the plant *Calotropis procera* and the like which are of common growth in India the Malay archipelago and east Africa Good results are also obtained with the fibers of the *Chlorocodon Whytei*, a vine growing in the region of Amani. Another source of fiber is the material which surrounds the seeds of the *kickxia elastica* and others, and by a proper treatment these can be made up into threads which have somewhat the same luster as silk.

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12765) E B asks Please give me the rule for trisecting any angle, as I think that this would be of interest to a great many readers of the SCIENTIFIC AMERICAN A. Angles, excepting a very few cannot be trisected by ruler and dividers. They are, however so divided by the use of certain curves. A method of trisecting any angle was published in our SUPPLEMENT 1896, within a year and in SUPPLEMENT 1733 and so we cannot find space to republish it so soon again. We send the papers for ten cents each.

(12766) N V asks Is the statement made by a certain person that as far as invention concerns, the word invention has really lost its meaning and that it is nothing more than a proper application of well known mechanical principles. Is this correct or not? A The word invention is derived from two Latin words which mean to come upon Anything therefore which anyone finds out and embodies in a material is an invention within the meaning of the word in a material sense. In a general sense, a poem an oration or a musical composition is also an invention That certain principles must be respected in inventing is only to say that one cannot violate laws of nature and force or of mind and spirit. and still succeed We cannot agree with the statement that the word "invention" has lost its meaning or that invention has come to an end There are more unknowns than ever It was Sir Isaac Newton who said, I seem but as a child playing on the seashore, now finding some pebble rather more polished and now some shell rather more agreeably variegated than another, while the infinite ocean of truth extends itself unexplored before me. And every great discovery since his day has only made visible greater reaches of the unknown than had appeared before. How great the unknown which the finding of radium has disclosed! Nor is there any end in sight

(12767) R H C asks 1 Is there any method by which the image on a photograph print can be made to disappear and reappear at will? If so will this process affect the permanence of the print in any way? A We know of no way in which a photographic print can be made to appear and disappear completely If it could be done, it would most certainly injure the permanence of the print. 2 Could you supply me with a book or books, suitable for a high school graduate, covering the science of geology in as thorough a manner as the limitations of self-instruction would permit? Is there a book or chart showing the local geological phenomena? A We recommend and can supply you with Scott's Geology which is a recent work and which seems to us to come within the lines you lay down, a book which a high-school graduate can read with pleasure.

(12768) J E K asks Will you please tell me what position the needle of a compass would take at the north pole and at the magnetic pole? A At the earth's north pole the north end of the needle of a compass would point to the magnetic pole of the earth, or toward Hudson's Bay At the magnetic pole the needle of a compass would not have any power of direction, if it would be able to swing at all. If a needle is hung so as to swing up and down, the north end would point directly down toward the earth.

(12769) J F asks Can you explain the reason why a feather especially a gray one, may be used as an X-ray on a small scale by taking two cards and punching a hole through them then laying the fringe across the hole, and cementing the fringe, then cutting same off next to the quill, so that cards may be pasted together? A person may see the lead in a pencil or the bones in the finger Can you give any explanation for this penetrating power? A What you see by looking through the fringes of a feather is not an X-ray effect at all You can see the lead in the rod of a fire poker as well as in a lead pencil, or the bone in a round stick of wood as well as in your finger Anything held in front of the hole in the card will show the same effect. We have one on the desk before us which has a piece of coarse cloth, gauze and it works just as you describe. We have had this for a number of years. The curious appearance is due to the bending of the rays of light around the fine meshes of the cloth or feathers. It is called diffraction of the light, and is described in the text-books of higher physics.

(12770) C E A asks. Will you kindly inform me whether a fish sleeps or not, and how? Your consideration will be appreciated A. Upon the question "Do fishes sleep?" the Encyclopædia Britannica, last edition, has this statement "There is little doubt that all living beings require periods of repose alternating with periods of activity . . . Naturalists have observed many of the lower animals apparently in a state of sleep Insects, crustaceans, fishes, reptiles may all be observed occasionally to be almost motionless for considerable periods of time." Animals without eyelids cannot of course close their eyes as the higher animals do.

(12771) J L asks: I would like to ask you about radium 1 How is it discovered? A. Radium is an elementary substance, just as iron and copper are elements. It is found in exceedingly minute quantities in pitchblende, a mineral which is mined in Bohemia, and has not been found in any other part of the world thus far, although many claims have been made that it has been found in other places. There is no reason why it might not be found elsewhere in quantity 2 Is there any known method by which it can be located? A. It would be discovered by one who knows the character of rocks and minerals, and who should study the locality to find if such rocks might exist in that locality 3. What appearance has it when found? A Pitchblende is a shiny black rock, which might be taken for a piece of anthracite coal at first glance. It is very much heavier and harder than coal 4 What is its force or energy when applied to anything? A. There is not enough radium in a piece of pitchblende to show any energy nor would there be enough in a ton of the rock. We have published many papers upon radium You will find them indexed in our Catalogue of Valuable Articles, which we are sending you with this letter We shall be pleased to fill your orders for any papers you may select at ten cents a copy See page 23 of the catalogue

(12772) J W W asks Will you please send the chemical analysis of ocean or salt sea water i. e. same analysis of waters in some of the larger bodies of salt water? A. In sea water there is about 3.5 per cent of solid substances altogether in weight or 35 000 parts in a million. This gives weights as follows

Sodium chloride	27 213
Magnesium chloride	3,807
Magnesium sulphate	1,658
Calcium sulphate	1,260
Potassium sulphate	0.862
Calcium carbonate	0,123
Magnesium bromide	0,076
Total of solids	35,000

Our figures are taken from the latest book on the subject The Depths of the Ocean by Sir John Murray published last year which we can send for $7.50 by express prepaid, and we shall be pleased to receive your order for a copy It is the best work we know upon the ocean and the methods of its exploration.

(12773) W B B writes The matter I wish to discuss may be old as the hills, but for the reason that I have never seen the theory advanced by any authority I call your attention to it. Some years ago while listening to the late Daniel Drawbaugh (inventor of the telephone) a schoolmate of mine, explaining the operation of his electric clock in about these words I know that a constant current of electricity is passing round the earth from east to west, created by the opposite movement of it (the earth) I conceived the idea of securing enough of this current to give a sensitive effect then again I planned to give movement to a clock by planting deeply in the earth two copper plates with wires attached, one on the eastern side the other on the western and these wires to connect with a large permanent magnet the key to the magnet being attached to the long wire of the pendulum, and the swing of the pendulum this tilting the key that the ends would alternately touch the positive and negative poles of the magnet and thus giving movement to the clock and I succeeded. The clock had been running about fifteen years when Drawbaugh explained it to me. After thus hearing his explanation I remarked 'Then, according to your theory, Dan, the earth must be a great dynamo the first, original one, and in operation so long before we knew what a dynamo was. This line of thought finally led me to consider that really the movement, or rather rapid motion of the earth revolving from west to east must bring about dynamic results, and that like any other dynamo electricity is thrown off from the axis in a powerful current and this electric current is shown in the Aurora Borealis or northern light. So far so good Now such being the case, what effect would this current have on a man standing on the exact pole? If my theory proves the correct one, could a man reach the true pole and live? If I am correct neither of the so-called pole discoverers ever reached the true pole. Am I right? A. Your observations upon an electric current in the earth are not new, although doubtless original with yourself, and the running of a clock by electricity generated in the ground has been done by others in the past, although we cannot decide the question of priority. We described the construction of such a clock in SUPPLEMENT 1800 December 1st, 1909, in which you may be interested and which we send for ten cents. As to a current of electricity emerging from the earth's poles, an earth current around the earth from east to west would not produce such a current of electricity, but would produce lines of magnetic force which would emerge from the magnetic poles of the earth. These lines do not affect the human body in any way. [illegible] [illegible] A person at the geographical pole of the earth is nearly 1,000 miles from the magnetic pole, and would not perceive any [illegible] from what he would perceive at any other point of the earth. There is no [illegible] [illegible] [illegible]

SIXTY-NINTH YEAR

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Wreck of a train at Yost, New York, caused by the flooded Mohawk River The passengers were rescued with difficulty

Transportation by boat in First Street, Troy, N. Y., when the Hudson River invaded the city.

THE RECENT GREAT FLOOD.—[See page 336.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

A Problem of National Proportions

THE floods in the upper watershed of the Ohio, with their tragic accompaniment of suffering and widespread ruin, will have carried with them a large compensation if they prove to this nation that the question of the control of the Mississippi River and its tributaries is broader than any State or community and that it must be faced and mastered by the nation at large.

If anyone asks why the Federal Government should be urged to take hold of this problem on a national scale and assume full responsibility for the time and labor and great cost involved in obtaining complete control of the Mississippi River, surely it is sufficient to remind him that the drainage basin of this great river covers forty-one per cent of the total area of the United States. A line delimiting the frontiers of this area starts on the Louisiana coastline, sweeps westerly through Texas, and then northwesterly through New Mexico, Colorado, Wyoming, Idaho and Montana, swings across the Canadian border line to re-enter the United States in North Dakota, then passes on its easterly bearing through South Dakota, Minnesota, Wisconsin, northern Illinois, northern Indiana, Michigan, Ohio, and even swings into New York before it passes on its southerly bearing through Pennsylvania, Virginia, North Carolina, Georgia, and Alabama and finally reaches the Gulf again through Mississippi and Louisiana.

If we except the arid regions, every square mile of this vast territory contributes its quota, be it large or small, to those floods which, with persistent regularity, overflow the twenty million acres of land which lie between St. Louis and the Gulf.

True it is that some of the floods, such as that which a few weeks ago devastated the upper valleys of Ohio, and is to-day threatening the lower regions of the Ohio and the Mississippi, are comparatively local in their origin and effect, but this merely points the moral that any adequate treatment of this stupendous problem must be based upon the broadest kind of a survey of the whole situation, in which every possible agency which may be contributory to disaster is investigated.

The drainage basin of the Mississippi River covers 1,240,050 square miles, and of this total the Missouri basin covers 527,150 square miles, the Ohio basin 201,700 square miles, the Arkansas basin, 186,300 square miles, and the upper Mississippi basin, lying above the junction with the Missouri River 165,000 square miles. In the Red Basin are 90,000 square miles and the Central Valley lying between the Missouri River and the Gulf of Mexico, covers 60,000 square miles. Although the Missouri basin is by far the largest, it is comparatively a dry region, and its rainfall is moderate. The Ohio basin constitutes the zone of heavy precipitation and although in area it is less than half as great as the Missouri basin it contributes about three times as much water to the Mississippi River during the year. Moreover, there is apt to be a wide difference in the various basins between the rainfall and the run off. The Missouri basin, for instance, where the soil is sandy and highly absorbent, and the winds are dry, delivers a much smaller percentage of its rainfall to the main river than does the surface of the Ohio Valley. Thus the Missouri has an annual rainfall of 19.6 inches and a run-off into the river of but 12 per cent of this. Of its annual rainfall of 34.7 inches the upper Missouri delivers but 27 per cent to the river. The Ohio basin, on the other hand, with an annual rainfall of 43 inches, delivers 30 per cent of this into the river.

It will be readily understood from the above comparison that if the levees in the lower regions of the river are to be assisted in their work of keeping the flood within its banks by a system of reservoirs at the head waters, the most promising field for investigation is the upper reaches of the Ohio, and its tributaries. It is, of course, doubtful if any system of control of this kind could cope with such a four days' rainfall as caused the recent floods, but it might greatly mitigate disaster, and it is for the Federal Government to undertake immediately the necessary surveys to determine what can be done along these lines.

That the rapid denudation of our forests has increased the total volume and the speed of the run-off into the rivers during heavy rains cannot be disputed. This suggests that any movement for Federal action should receive the hearty co-operation of the powerful interests which are working for forest preservation and for the reforestation of denuded lands. Also, if the Government investigation should show that reservoir construction would materially assist in Ohio and Mississippi flood prevention, the Reclamation Service should prove to be a powerful factor in the new movement. Furthermore, this would be the time to draw up a definite policy with regard to the preservation and control by the Nation of its water powers.

If ever there was a great National undertaking which called for intelligent co-operation and thorough organization, it is to be found in the control of our greatest river.

Above all, Congress should avoid hasty and ill-considered action. The problem should be considered from the broadest national standpoint; and the final plan should be agreed upon, only after this great question has been viewed from every possible standpoint and submitted to the highest technical investigation.

Finally, whatever may be done, let it never be forgotten that by far the most important and pressing obligation is the completion as early as is physically possible of the system of levees and revetments throughout the full length of the rivers affected.

The Thousand-foot Ship

NOT so very many years ago, that distinguished naval architect, the late Sir William White, surprised the world by stating that if the conditions of transatlantic traffic called for a 1,000-foot ship, it would be perfectly practicable to build and operate a vessel of that size. Few of us at that time dreamed that there would ever be a call for such a huge vessel, yet so rapid has been the development of transatlantic travel, and so industrious have been the dock and harbor commissioners on both sides of the Atlantic, that not only is accommodation in the way of channels and piers being made ready for such a ship, but thanks to the enterprise of the steamship companies, the 1,000-foot ship is within sight. The launch of the "Vaterland" (formerly known as the "Europa") for the Hamburg American Line has carried the transatlantic liner up to within fifty feet of the thousand foot limit suggested by Sir William White as a remote possibility. If we remember rightly, his statement was made at the time of the appearance of the White Star liner "Oceanic," the first ship to exceed the length of the "Great Eastern" (692 feet) and the first to exceed the limit of 700 feet. Since her appearance the progression has been rapid. She was followed by the "Adriatic," 725 feet over all, the "Lusitania," 790 feet, the "Oceanic," 882½ feet, then by the "Imperator," 920 feet, and now by this 950-foot ship. A third vessel is building upon the docks at Stettin. She is to be larger than the "Vaterland," and if her length is increased only by the freeboard of the "Vaterland" at her stemhead, this ship will have the distinction of being the first 1,000-foot vessel.

Frequently the question is asked, what is the limit of practicable size? How big will be the liner of ten or twenty years hence? In reply it can be confidently said that the physical limitations are those only of the depth of our entrance channels and the length of our harbor piers. Judged from the economic standpoint, from the point of view of revenue earning for the steamship companies, there is every inducement to build these transatlantic liners in ever increasing sizes, provided of course that the speed be maintained within reasonable limits. It may be broadly stated that the larger the ship, the less the cost of carrying a given number of passengers and a given tonnage of freight. The same principles which have led our railroads to build 50-ton cars and 300-ton locomotives encourage our shipbuilders to produce vessels 1,000 feet or more in length.

Why We Need an Aerial Navy

EVER since the record 31-hour flight of the new German naval Zeppelin airship on October 13th and 14th, 1912, in which, by the captain's own admission, the airship traveled a distance of 1,067 miles, the British military authorities have been greatly agitated. At about 1 A. M. on the morning of October 14th, 1912, a large dirigible was seen over Sheerness, the military outpost near the mouth of the river Thames. The airship is known to have traveled to the island of Heligoland, in the North Sea, and thence along the German coast, after which it circled back to Berlin. Notwithstanding that the weather was foggy, the captain was in communication by wireless with various points in Germany throughout the entire voyage and was able to calculate his position from his known speed and from the direction in which he traveled. Besides carrying fuel enough for a 50-hour flight the airship had an extra lifting capacity of two tons available for ammunition. As there is no longer any doubt about the havoc that can be wrought by bombs dropped from aeroplanes and airships, the British War Office was greatly stirred by the reported appearance of this airship, and England's Minister of War has set to work in serious earnest to secure a suitable air fleet for the Island Kingdom.

The descent, on April 3rd, after a flight of some seven hours from Friedrichshaven, of the latest German "Zeppelin IV" on the parade ground at Luneville, France, as a result of its becoming lost in the clouds at a height of some 10,000 feet, affords further proof how easy it is for an airship to start in one country and land in another.

The announcement of a prize of $50,000 by the *London Daily Mail* for the crossing of the Atlantic in an aeroplane within 72 hours has brought to the attention of the American public the possibility that a modern Zeppelin might cross the ocean and attack this country in time of war. The latest Zeppelin airships with four motors are credited with a speed of 60 miles an hour in still air, and if one of these reached the altitude in which a favorable wind was found, it could probably cut several hours off this time. This would mean that after crossing the ocean inside of a day, the airship could attack cities such as Portland, Me., or Boston, Mass., and return across the Atlantic without replenishment of fuel. It would be an easy matter, however, to have warships convoy the airships and carry the necessary supplies of fuel and ammunition. The refueling of a Zeppelin from a collier has been accomplished several times in the North Sea without any difficulty.

Now that both the army and navy of the German Empire have ordered twenty huge Zeppelins and ten Schutte-Lanz dirigibles, it would be well for Congress to consider whether it would not be wise to undertake the construction of a dirigible of large size for experimental work, and make a generous appropriation for an up-to-date aeroplane fleet. During the last five years Germany, France and Russia have spent $28,000,000, $22,000,000, and $12,000,000 in the order named for aeronautics. Italy, Austria, and England have spent eight, five, and three millions, Belgium, two, Japan, one and one half, and Spain, $550,000, whereas in the United States of America, only $435,000 has been expended and we have to-day less than a score of aeroplanes and one out-of-date dirigible, as against the large and efficient fleets owned, respectively, by France and Germany.

Potash Fertilizer and Frost

EXPERIMENTS made in France by W. Gotte show that potash fertilizers have the property of protecting crops against damage from frost. In order to show what results are obtained in different cases he proceeds as follows. Three areas of a quarter of an acre each were sown with rye. The first area did not receive any fertilizer, and on the second and third there was spread 200 and 130 pounds, respectively, of the fertilizer known as "kainite." After a period of heavy frosts it was found that the ground of the area which was strongly fertilized had not been frozen. The second or less fertilized area was much less frozen than the untreated field. The author considers that this effect is no doubt due to the saline solution at the surface of the soil. However, he finds that the sprouts on the strongly treated area were less flourishing than the others, and the leaves seemed to have lost a considerable percentage of water by plasmolysis. But during the thawing period, the pathological symptoms disappeared and the plant showed a rapid and vigorous growth. On the contrary, on the non-treated area the effects of the frost were shown by a yellowing of the leaves. As is known, the damage caused by freezing is due to the fact that the water contained in the inter-cellular spaces destroys the tissues by a tearing action due to alternate freezing and thawing. The fertilizer temporarily removes a great part of the water from the plant, and thus has the effect of dimin-

Engineering

The Loetschberg Railroad Completed.—By this time trains should be running over the Loetschberg railroad, which joins Berne with Brieg, the last rail having been laid on the 28th of February. This road opens a new highway between the north and south of Europe by way of the Loetschberg and Simplon tunnels across the central Alps. By the new route the distance from Calais to Milan will be 675 miles, which is shorter by eighty miles than any existing route.

A Record Spring Test.—During the course of some recent tests of locomotive spring steel made of vanadium steel, a fiber strength of 256,000 pounds per square inch as the elastic limit was developed. This, as far as our knowledge goes, constitutes a record for locomotive spring steel. Carbon, oil-tempered springs showed an elastic limit of 101,000 pounds, chrome-nickel, spring-tempered springs, an elastic limit of 134,500 pounds, and the chrome-vanadium oil-tempered springs showed a limit of 250,000 pounds.

Battleship with Four-gun Turret.—Multiple-gun turrets are certainly in favor just now, for the French authorities have decided to adopt four guns in each turret for their four ships of the "Normandie" class, which are to be laid down this year. There are three turrets, one forward, one amidships just abaft the smokestacks, and one on the quarter-deck. These ships are 574 feet long, 87 feet 7 inches broad, and displace 25,200 tons on a 28-foot 4-inch draft. The armament consists of twelve 13 4-inch guns and twenty-four 5 5-inch guns. The armor belt is 12½ inches in thickness.

Panama Canal to be Rendered Impregnable.—As a result of the visit of the members of the House Naval Affairs Committee to Guantanamo, Cuba, and Panama, it would seem that the members are in favor of rendering the canal impregnable, and placing a garrison at Panama of sufficient strength to prevent a hostile force from making any attack upon the canal throughout its entire length. Col. Goethals stated before the House Military Committee last January that a garrison of 25,000 men would be needed for this purpose. This is a large force, but when we consider the magnitude of the interests involved, it does not seem to be excessive.

Satisfactory Solution of a City Nuisance.—The successful introduction of electric traction for the suburban service of railroads, as exemplified in the electrification of the New York Central and New Haven railroads, has led to the formulating of a proposal for electrifying the New York Central freight tracks from the northern limits of the city down to 72nd Street. This will give to the New York Central Railroad a better service, and will solve the problem of the smoke and noise nuisance which is occasioned by the present open tracks of that railroad along the shoreline of Riverside Park, New York. The Board of Estimate of this city has arranged with the New York Central Railroad to place its tracks in a subway, the surface of which will be formed into a broad driveway, the space between the tracks and the river being turned over to the city to be laid out as a part of the Riverside Park system. The tracks will be operated electrically.

Continued Sliding at Culebra Cut.—On the night of March 12th to 13th the break in the east bank of the canal, opposite Culebra, which first moved its bank on the night of February 5th, again made another rapid movement downward and toward the canal. The bottom of the canal, according to the *Canal Record*, was heaved up for a distance of about one thousand feet, to a maximum vertical height of about thirty feet, destroying five tracks in the bottom of the canal, and leaving only one track in commission. The canal engineers are not dismayed, and they have already placed steam shovels at work removing this material. Later when the water is turned into this section of the cut, the two new floating dredges will be placed in service and they will remove material at the rate of one million three hundred thousand cubic yards per month.

Columbus and the Panama Canal.—It is stated that the three models of Columbus's ships, built in Spain and sailed here and exhibited at the World's Fair at Chicago in 1893, are to be exhibited at the Panama-Pacific Exhibition in 1915. If the plans are carried out, the little craft will leave Chicago, pass down the Mississippi, through the Gulf of Mexico, and so through the Panama Canal and up to San Francisco. There is something very appropriate in the suggestion; for it was in the search for a westward passage to India that Columbus set out on his classic voyage. On the last of his four voyages, he reached the Isthmus of Panama, and his name is commemorated at Colon. The vessels made the passage over the stormy Atlantic Ocean and it is not asking too much that they should cross the Gulf of Mexico and sail up the western coast to San Francisco, always supposing that they have been [illegible] for good repair during their long sojourn at Chicago.

Aeronautics

$50,000 for a Trans-Atlantic Aeroplane Flight.—The *London Daily Mail* has just made an offer of $50,000 for the first aeroplane which shall fly across the Atlantic Ocean in either direction in 72 hours time. The flight must be made between England or Ireland to or from any point in the United States, Canada or Newfoundland. This prize is international and may be competed for by all aviators throughout the world. It is permissible to alight upon the water and take on more fuel if this can be arranged for. About a year ago there was a great deal of discussion regarding the trans-atlantic flight, but now that a real prize has been put up we believe that the flight will be made, if not this year, at least in the summer of 1914. Such manufacturers as Blériot, Herr Rumpler, and Col. Cody have already announced their intention of competing for this prize.

A $25,000 Prize for British Aeroplane Constructors.—The *Daily Mail* has also offered $25,000 for the first aviator who shall fly around England, Scotland and Wales and as far as Ireland, that is, within one mile of Kingstown Harbor, in 72 consecutive hours. The machines are not allowed to descend upon land at any point, but they may stop in harbors for fuel replenishment. They are to be hydro-aeroplanes or flying boats and not land machines. This prize is offered for British constructors and aviators only. These two prizes are the first big sums that have been offered for several years to promote progress in aviation. The Gould prize of $15,000 offered in this country three years ago had but one serious contestant, when the competition was to be held, last Fourth of July. This prize was offered for a two-motor aeroplane, the type of machine which will undoubtedly be needed to accomplish the trans-atlantic flight just mentioned.

Record Flight with a Passenger on the Pacific Coast.—On Sunday, March 23rd, a fast flight was made from Los Angeles to San Diego, Cal., by W. L. Bonney with his Deperdussin monoplane, carrying Miss Margaret Stahl as passenger. The start was made from Los Angeles, at 1.30 P. M., and after a continuous flight of an hour and eight minutes, Bonney alighted at Oceanside. He started from this place at 3 16, and finally landed to the south of San Diego, at 3.56 P. M. He had adverse weather conditions to contend with on the flight and also became confused as to his landing place because of a number of bonfires that were lighted in the vicinity. He was supposed to land beside a huge bonfire at San Diego. As a result of his confusion, he made a bad landing and broke the running gear of his machine. The time of 108 minutes for the 112 miles between Los Angeles and San Diego makes his average speed for the flight 62.22 miles an hour.

Record Cross-country Flights in Germany and the United States.—By a strange coincidence, army men in Germany and the United States have recently made lengthy cross-country flights and broken all records. On the 30th ult. Lieutenants Canter and Bohmer, starting from Juterbog, near Potsdam, flew across Berlin and Lubeck and as far as Closs in Schleswig-Holstein. They were in the air 6 hours and 9 minutes and covered a distance of 372 miles, thus averaging 60 miles an hour. On March 29th, Lieuts. Milling and Sherman of the Signal Corps Aero Squadron No. 1 flew from Texas City, Texas, to San Antonio, a distance of 237 miles, in 3 hours and 20 minutes, or at an average speed of 71 miles an hour. Upon arriving at the latter city, they remained aloft for another hour, making a total duration record of 4 hours and 22 minutes and breaking the existing American record by 31 minutes. Two days later they flew back to Texas City against a strong wind in 3 hours 50 minutes. They used the new Burgess tractor biplane fitted with a 70 H. P. Renault motor. Both the German and American flights set up new records for cross-country flights with a passenger.

$37,500,000 for a German Aerial Fleet.—The latest plans of the German Admiralty for a huge aerial fleet to accompany the warships have recently been made public. These call for an expenditure of $12 500,000 to be spent during the next five years, while the appropriation for army aviation and aeronautics is to be nearly $25,000,000. In a bill introduced into the Reichstag on March 29th, a large appropriation was made for ten naval dirigible balloons of the largest size, eight of which are to be put in service and two to be held in reserve. To house these dirigibles, fifty-four double revolving balloon sheds are to be constructed. With this new type of shed, the dirigibles can be housed at any time, no matter what the weather. Extra sheds are to be built as a reserve. Fifty aeroplanes (thirty-six for active use and fourteen for reserve) are to be built and are to be manned by a special corps of 1,452 officers and men. The total appropriations for the fleet of aeroplanes and dirigibles to be spread over the years from 1914 to 1918 amount to $8,750,000 for dirigibles and $2,250,000 for aeroplanes, while $1,500,000 extra is asked for paying the aviators and men who man the airships. The life of each of these new Zeppelins is estimated at but four years.

Automobile

An Automobile Lamp Trimmer's Wagon.—We have become familiar with the wagon having a high tower-like frame used by linemen for supplying electric arc lights. Patent No. 1,053,080 is for a lamp trimmer's wagon having an electric motor and controlling means extending into position to permit of its operation from the top of the elevated or towerlike structure.

New Motor Fire Engine for Uerdingen.—A new motor fire engine recently has been delivered to the city of Uerdingen, Germany, and under test an unusual capacity was demonstrated. The apparatus is self-propelled by means of a gasoline motor which, at 1 200 revolutions a minute, develops 75 horse-power, the motor also drives a four-stage centrifugal pump which at approximately 1,700 revolutions a minute yields as much as 500 gallons of water against a head of 300 feet. With nozzles measuring 30 millimeters in diameter jets of upward of 164 feet in height were obtained, the manometer pressure being 13 atmospheres.

An Automobile that Pulls Itself Out of Holes.—In a patent, No. 1,054,831, to Gay Victor De Peel of Crocker, S. D., there is shown a draft appliance for automobiles, in which a windlass detachably secured to the hub of the rear wheel has a rope connected to it and led forward through a friction guide carried on the forward portion of the automobile with the front end of the rope anchored at a suitable distance in advance of the automobile so that the engine may operate to wind up on the drum and draw the automobile forward the machine being suitably guided on the rope by the forward friction guide.

Cooling Pneumatic Automobile Tires. Andrew B. Craig of Tarkio, Mo., has secured two patents No. 1,049,077 and No. 1 049 078 wherein the pneumatic tire is cooled by suitable means which operate to secure a circulation of the cooling medium through the tire. The cooling liquid which may be salt water in summer or alcohol in winter, is circulated by a pump operated from the wheel through an air-cooled radiator and through a cooling tube in the tire in such manner as to maintain a sufficiently low temperature to prevent overheating the tire thus preventing blow-outs likely to result from the overheating and consequent expansion of the air in the tire.

Commercial Vehicles in Munich.—The city of Munich is putting in service a number of power wagon vans for transporting wounded horses. Such wagons can also carry eight or ten persons seated and in order to take in the horse, a platform is swung out from the back end so as to run down upon the ground. The horse is strapped onto this platform and the whole is run into the van by the use of a motor-driven windlass. Means are also provided for conveying the horse onto the platform from the street in the best way. The new Saurer vans are fitted with 30 horse-power gasolin or benzol engines and have single rubber-tired wheels in front and double in the rear.

The Four-tractor-wheel Type in France. A new type of power wagon is making its appearance in France, this being the tractor having all four wheels driven from the motor and acting as steering wheels. Besides the Panhard wagon to which we referred the Blum-Latil and the Balachowsky are newer ones of like principle. The well-known Creusot works are engaged on the same subject, it is said. It will be remembered that this firm supplied a good part of the autobuses in Paris, with the De Dion company. It is recognized that the army is greatly in need of a good tractor for use with a trailer car or a train of cars. Most of the present power wagons, which are excellent are designed mostly for separate use with three to five-ton net load and these are in extensive use in the army and as subsidized private wagons. It is even proposed to hold a separate concourse for new tractors, quite outside of the regular annual military power wagon endurance test, so as to compare the tractors among themselves.

Gasoline in War.—Commandant Ferras considers that the fuel question for automobiles and especially for power wagons is a vital point for the French army, as a large amount of gasoline needs to be imported. From 1910 to 1912 the imports rose from 25 000 000 to 50,000,000 gallons, America furnishing a large part. Home production of fuel is desired, but this is a difficult matter. Among the fuels, benzol has only a limited production, and each country is likely to absorb its own product. Thus Germany produces 200 000 tons of benzol and at the same time consumes 700,000 tons of gasoline. France produces but 10,000 tons and this is not enough even for the autobuses in Paris, which need 16,000 tons. Alcohol is a home product but it is dear and the price fluctuates by speculators' maneuvers. Chemists are occupied with new products, but we must wait for these. Petroleum or heavy oil, however, seems to have a good future should inventors be able to apply it as well to automobiles as in the Diesel engine. Schist oil is extensively found in France, and there is a good outlook in this direction.

Fireproof Shelter for Refuse Receptacles

IT is very evident that the empty garbage can may be quite as great a menace as the full one, if not properly cleansed and sterilized. And hence the storage of the can is at all times a matter of vital importance. Closely associated with garbage disposal is that of ashes and waste paper. While it does not present a sanitary menace, such refuse matter is dangerous by reason of the fires that it may cause.

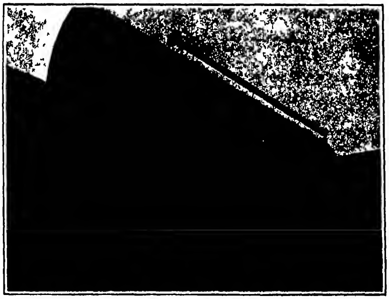
To take care of all this refuse matter and the receptacles in which it is contained an excellent suggestion has been made by Mrs. Flora Spiegelberg. She proposes that fire-proof rooms should be made in the cellar or basement of the building to receive the garbage and ash cans. It is essential that such a room be well ventilated. A terra cotta wall, metal doors and windows for ventilation are practically all that is necessary. Of course such a room should have easy access to the street. Where there is no basement or where the basement is used for storage a shelter should be built at the back of the building, such as illustrated in the accompanying drawing. The ideal shelter should contain a metal box for papers and also a place for washing the cans after they have been emptied. This idea has met with the approval of the Health and the Fire Commissioners of New York city and of the Chief of the Fire Prevention Bureau. Such shelters, if required by the building code, would do away with fires that are now of common occurrence, due to stowing of paper, excelsior, rags, and other materials near elevator shafts and under wooden stairways.

Mrs. Spiegelberg points to the fact that similar conditions exist under open iron gratings in front of many shops. In front of garages receptacles containing oil soaked rags are frequently left standing without any cover over open gratings under which gasoline is stored, and often wooden boxes and barrels are placed beside these oil soaked rags and papers. Added to the danger of spontaneous combustion is that of the lighted match, cigar or cigarette carelessly thrown into the fire trap.

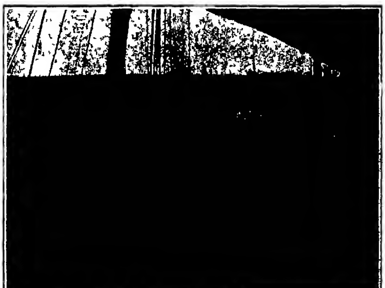
Fireproof room for garbage and ash cans and waste paper.

The Smokestack and the Rudder of the "Imperator"

IT is difficult to convey an adequate impression of the size of a huge modern Atlantic Ocean liner by means of photographs or drawings. A mere photograph does not tell the story unless there is some object alongside that may be used as a basis of comparison and even then it is difficult to grasp the full dimensions of the vessel for the reason that the object with which it is compared must of necessity be enormously large so large in fact that it itself must be compared with a smaller object more within our ken. A better method is to dissect the ship and show certain details of it as compared with smaller and more familiar objects. In the accompanying illustration we show a section of one of the smokestacks of the new giant liner "Imperator." The smokestack is elliptical in section, and the major axis of the ellipse is thirty feet long. The stack would form a tunnel of ample dimensions for a locomotive and train to pass through. Standing beside the section of the funnel is a man who is completely dwarfed by the bulky steel cylinder. The smokestack of the "Imperator" will extend sixty nine feet above the deck. Sixty nine feet is the height of an ordinary six story house. The rudder of the "Imperator" weighs ninety tons, and the stock on which it swings weighs 110 tons. Despite its enormous weight the rudder will be moved at the delicate touch of a wheel on the bridge nearly a sixth of a mile away. The "Imperator" will have a total length of 910 feet; her sister ship the "Vaterland," just launched, 950 feet long. A complete description of this vessel will be found in the current SUPPLEMENT.



A section of the huge smokestack of the "Imperator."



Mounting the 90-ton rudder on the "Imperator."

Circassian Walnut

CIRCULAR 212, entitled "Circassian Walnut," is the fifth number of a new serial admirably promising to supply a void in the library of the young forester, as well as in that of the wood user. It is a very interesting and important contribution to the history of the use of one of the best known woods in the world. The subject is discussed in the following chapters: Common names, uses, native and cultivated range, sources of supply, logging and transportation to market, waste in preparing logs for shipment, consumption of Circassian walnut in the United States, gross characters of the wood, minute characters of the wood, substitutes for Circassian walnut.

The trade name of this wood is Circassian walnut, so called because it comes principally from Circassia, which lies between the Black Sea on the southwest and the river Kuban on the north. It is not generally known that this tree is the same as the English walnut, the fruit of which is found in every market. It is now one of the most widely distributed of the commercial timber trees. There is no authentic record as to when Circassian walnut was brought into the United States. Here it has been planted from the Atlantic to the Pacific, the greatest attention having been given to it on the Pacific Coast, where it is grown for its nuts. Since wherever it is grown in the United States it is for this purpose, the wood produced is of little importance.

The Circassian walnut is remarkable not only because its wood is so attractive and valuable that the best grades often bring a higher price than mahogany, but because it grows to a considerable size, and attains a great age. An English writer relates that the architect Scannonzi saw a table made of a single piece from the trunk of a walnut, which was 25 feet in breadth, and of a proper length and thickness. It was upon this board that the Emperor Frederick III had a splendid entertainment in 1724. The age of the tree was estimated to be about 900 years. Referring to the logging and transportation of this wood and the waste in preparing it for market, this circular points out the alarming extent to which Circassian walnut is approaching exhaustion. It informs the reader that the supply is often very limited, and, in fact, invariably fails to meet the demand. Realizing the importance of a home supply, France passed an act in 1720 prohibiting the exportation of Circassian walnut. In consequence, large numbers of plantations were established throughout England, France, and Germany. Some of these were very extensive, one founded in 1818 near Boulogne, France, contained about 30,000 trees. Nothing new is given in reference to the gross structure and mechanical properties of the wood, but the old facts are presented in language which the layman will easily understand. Another chapter is devoted to a consideration of the structure and composition of the wood, but it is purely elementary and singularly free from technicalities. Substitutes for this wood are also dealt with and the reader cautioned to guard against spurious kinds which now masquerade in the market as Circassian walnut.

Urbain's Researches

IN his report upon the work of Prof. G. Urbain of the Paris University, who recently obtained the La Caze prize awarded by the Academy of Sciences, M. Le Chatelier sums up the main points of these researches upon the rare earths, and mentions a number of new elements discovered in this way. During the course of his researches to find the rare elements M. Urbain made more than 100,000 fractional crystallizations. We wish to bring out the new elements which he found in this way, or at least, definitely established. He first isolated the metal *europium* in a pure state and showed its real existence, it being identified with bodies described by Crookes and Lecoq de Boisbaudran, whose somewhat different properties were due to impurities. Next he established that *gadolinium*, which Demarcay had obtained in a pure state, is the same as the victorium of Crookes, this latter having quantities of yttrium with it. The atomic weight of gadolinium is now fixed at 157.3. M. Urbain then produced *terbium* in the pure state, and its atomic weight is 159.2. He identifies it with elements sought by others, which Crookes called ionium or incognitum. All doubts upon these various points are now cleared up. Next, the metal *dysprosium* is identified with bodies mentioned by Demarcay, Crookes and others, and its atomic weight is 162.5. The most brilliant piece of work done by M. Urbain was to show that what was called ytterbium is in reality made up of three bodies which are no doubt simple elements, these new metals being *neoytterbium*, atomic weight 170, *lutecium* (174), and more recently the element *celtium*.

Safeguarding Machinery at Hawthorne

How an Electric Company Protects Its Shop Employees from Injury

Fig. 1.—A punch press fitted with a guard which will swing down in front of the die space when clutch rod is operated by the treadle. Position of guard is shown before treadle is pressed and while work is being put in machine.

Fig. 2.—Stationary guards for protecting the complicated parts in a heavy press for forming the housings of metal subscriber sets.

Fig. 3.—View of a punch press fitted with a guard which swings down in front of the die space when the clutch rod is operated by means of the treadle. The position of the guard is shown after the treadle has been pressed and machine operated.

THE present workers in the field of manufacturing industry are witnessing one of the most radical periods of evolution in the history of mechanical appliances.

Occasioned, no doubt, by present-day competition and by the constant demand for cost reductions, engineering skill is now being concentrated upon the production of highly efficient equipment, tools specialized to particular classes of work, and devices of many kinds designed to perform work which is difficult of execution by an operator.

One of the most important results of this general change through which the art of manufacture is passing, is the occupational adjustment demanded of the workmen. Manual operations, which have become familiar often by years of execution, are changed to the supervision and working of machines adapted to perform these operations more quickly and accurately. These manual operations were not without their associated dangers, but the dangers were thoroughly recognized, and the experience of the workmen provided the safeguards. Machinery, however, introduced new hazards for which experience had no safeguard.

Unfortunately, the evolution from manual to mechanical operations has been so rapid that the designers and manufacturers of modern machines, tools, and appliances have been forced to devote too much attention to the demand for higher speeds, greater power and lower cost, and until recently have given too little attention to the safety of the machine operators, to whom each increase in speed or power or each addition of new mechanism introduces new and unfamiliar risks to be guarded against. The manufacturer of machine tools today is giving this feature due consideration in the design of his product, and in most cases moving parts of machine tools, such as gears, fly wheels, and pulleys, are adequately protected from accidental contact.

The machines in the manufacturing department of this electric company in Hawthorne, Ill., have always been given careful consideration so that they might be equipped with the necessary devices to protect those who come in contact with them. In addition to the general precautions which have been observed, a systematic campaign has been carried on during the past two years to reduce to a minimum the risk of injury in operating the machinery. During this period a group of from six to twelve men have devoted their entire time to fitting up machines with special safeguards. This work includes not only the covering of dangerous moving parts with guards, but also designing the associated tools so as to prevent accidents.

To offset the conditions which introduce hazards, careful analyses have been made of all situations which might be the cause of accidents, and wherever possible these conditions have been counteracted. The following are some of the more important. All belt shifters, switches or other devices controlling the operation of

Fig. 4.—View of a method of safeguarding a wood working machine.

Fig. 5.—A circular saw woodworking machine with guard over belt to keep the latter clear and a guard over the saw. The second guard prevents injury to the hands and the wood from coming together at the saw, jamming up and ramming the operator.

Fig. 6 shows a vertical spindle molder or "sticker" for woodworking with guard over cutter to prevent injury to hands. The machine grooves wood and all saw-dust is removed by means of an exhaust system to which a hood is connected.

Fig. 7.—In this view the picture shows a multiple spindle drill press provided with sheet metal doors (A) in front of spindle driving shafts (B) to prevent them from flying out in case they become disconnected at the universal joints (C).

machines are located within easy reach of the operator, so that he may start or stop the machine without moving from his position while at work. In all operations which are injurious to the eyes, such as the dressing of emery wheels, goggles are furnished to be worn while the work is being done. It is an established fact that lighting conditions are responsible for a large number of accidents, and very careful consideration has, therefore, been given to the proper illumination both of the departments and of the individual machines.

Guards are provided to protect moving parts of machines which project in such a way as to be a source of danger; to protect belts or chains driving machines from motors on the machines or on the floors, and also belts driving machines from countershafts to pulleys located on aisles; to protect all gears, to protect cutters in metal working or wood working machines, such as milling cutters, circular, band, and jig saws, and wood shaper cutters, and to protect emery and polishing wheels.

Some idea of the extent to which this work has progressed is obtained from the report of the Telephone Apparatus Shops at Hawthorne for the past year. A total of 1,107 guards of all types was installed, comprising 261 guards for covering gears, 200 for covering belts, 108 for protecting milling machine cutters, 105 celluloid shield guards on automatic spool winding machines, and 411 appliances of a miscellaneous nature. The guards are generally of three kinds: stationary guards for belts, gears, and other exposed moving parts; adjustable guards for saws and cutters of various types; and mechanically operated guards for use on punch presses. Aside from these are the various tools and feeding devices designed for the protection of the workman's hands while operating the different machines.

A better idea of the diversity of the hazards introduced by modern machinery, as well as the extent to which this humanitarian electric company has attempted to remove all dangerous elements, may be had by studying the illustrations shown of these types of guards. Fig. 2, which shows a stationary guard, has been selected to illustrate the complicated design of moving parts in one of the heavy presses for forming the housings of metal subscriber sets. In this case all moving parts into which the operator might slip, or be drawn by his clothing, are well protected. The guards, moreover, are so designed and located that they will in no way interfere with the operation of the machine at its highest efficiency.

Fig. 5 illustrates a typical adjustable guard applied to a circular saw. This is, perhaps, one of the most difficult problems encountered, inasmuch as it depends for its success upon the co-operation of the workmen. Guards of this type must be adjusted to suit the work being done.

A good example of a mechanically operated guard is shown in Fig. 1, which represents a gate applied to a punch press, which is closed before the downward stroke of the ram, rendering it impossible for the operator's hands to remain beneath the punch, the guard being in position before the treadle is pressed. In other cases, where the nature of the work is such that a guard of this description cannot be used, presses have been equipped with tools through which the stock is fed without making it necessary for the hands to be placed under the punch. In other cases dial feeds are employed, putting the work in proper position and swinging it under the operating part of the machine. The same results are obtained by sliding dies, and by chutes through which the parts are pushed to their proper location. In Fig. 1 the guard is in position after the treadle has been pressed and the machine operated. Fig. 6 represents a spindle molder or sticker, Fig. 7 a multiple spindle drill press, and Fig. 4 a method of safeguarding a woodworking machine.

During the past year the company has spent about $25,000 in designing and installing these protective devices. That the work has been done efficiently is proved by the fact that the Department of Factory Inspection of the State of Illinois has requested that we demonstrate our methods to other manufacturers as a guide in similar work. The Industrial Commission of the State of Wisconsin has also solicited information regarding the safety devices in use at Hawthorne, to employ in its campaign to provide for the safety of employees in manufacturing plants in that State.

A Scientific Investigation of Pianoforte Touch

At a recent meeting of the Physical Society Prof. G. H. Bryan read a paper on "The Dynamics of Pianoforte Touch," which should prove of much interest to at least three classes of people. The subject has in the first place a purely scientific interest; secondly, the makers of mechanical piano players should find in the researches carried out by Prof. Bryan most valuable indications of the direction in which they must move to improve the mechanism, however perfect it is even at the present day, of the mechanical piano player; and thirdly, the subject is one which appeals to every pianist.

There is a common impression that it is hopeless ever to expect the piano player to fully reproduce the touch of the virtuoso. While Prof. Bryan does not go so far as to positively assert that this impression is erroneous, he does insist that it should not be accepted without proof or test, and he has proceeded to carry out experiments to investigate just what is meant by "touch" and whether it is capable of being reproduced to a greater extent than hitherto upon pneumatically controlled pianos.

The question turns very largely on the extent, if any, to which the *quality* of individual notes can be varied by striking the notes in different ways. Such a possibility involves the inferences that (*a*) the intensities of the fundamental tone and its several harmonics are capable of independent variation, (*b*) these variations can only be produced by varying the behavior of the pianoforte hammer while it is in contact with the string for example, by lengthening or shortening the duration of contact, (*c*) such an effect can only be produced by rapid time variations of the pressure applied to the keys while they are being depressed, e. g., by a fairly rapid decrease or increase of pressure produced by smartly striking or heavily pressing on the key.

The author describes experiments which appear to indicate beyond all reasonable doubt the existence of such effects of "touch," and which certainly demonstrate the possibility of reproducing them by means of the modern pneumatic instrument. For this purpose the author's piano-player, which is a first-class instrument of standard type, but *with the whole keyboard under one common control*, was fitted with an auxiliary lever for which a patent application has been filed. This lever operates directly on the face of the auxiliary regulating bellows, and the air tension in the bellows can be regulated by means of a sliding weight placed on the lever, or by applying hand pressure to the lever itself. In this way *the touch of the human hand can be transmitted directly to the keys of the piano*. So far as the experiments go, they indicate that even if the lever is worked in conjunction with suitable expression marks, as could be done by a person of moderate experience, increased breadth of contrast is obtained, while by varying the position of the lever independently of the pedaling, a variety of dynamical effects can be produced, which can further be increased by hand control.

A short sharp pressure produces a bright ringing treble with a light bass, a sustained pressure produces a rich bass with a soft treble, the general character of the tone being suitably described as "metallic" in the first case and "woody" in the second. A very conspicuous feature of these experiments is the marked differentiation which they show between notes in different parts of the scale, especially in chords, the notes of which are accurately ranged (as is unfortunately often not the case in music rolls). The duration of the pressure required to produce the maximum effect on a particular note of the piano varies continuously from the treble to the bass end, being least in the treble and greatest in the bass, and by means of this natural or dynamical differentiation notes in a particular part of a chord at any part of the scale can be accented independently of the rest.

Whether it is possible to vary the quality of individual notes is a point that can only be tested by playing single notes as opposed to chords. The differences that can be effected can only be noticed by a trained ear, in the author's experiments it has been found that some persons notice *very marked* differences, others notice very slight differences, others no differences at all. The differences are probably as conspicuous as those between a stopped string and a harmonic on the violin. It is not always easy to produce these differences for purposes of demonstration, though it is often easier to do so in the course of playing through a suitable composition. In any case the author finds that the effects can be obtained more easily with a pneumatic player fitted with an auxiliary lever than in striking the keys with fingers. When the lever is disconnected the change observed affords some indication of the origin of the popular belief in the limitations of the pneumatically played piano.

"Sitting Dharna" and Hunger Strikes

As has been pointed out by a correspondent of the London *Times*, the hunger strikes of the English suffragists represent the revival of a very old and once widespread custom, known in the East as *dharna* (or *dharna*) *baithna*, or "sitting dharna."

This custom was once very common in India, but is now almost obsolete. It was chiefly resorted to, in order to force payment of a debt. The debtor would sit at the creditor's door and taste no food until his claims were satisfied. If the debtor allowed the creditor to starve it was believed that he laid himself liable to supernatural punishment, especially if the starver happened to be a Brahmin; accordingly, Hindus of lower caste would sometimes engage a Brahmin to starve for them. The custom was much abused, being used to levy blackmail upon persons who were not debtors at all. It also gave rise to various analogous practices, e. g., that of certain beggars in the Punjab, known as "strap-riggers," who twist a leather strap around the neck and throw themselves on the ground before a shop until alms are given them. Again, in order to obtain compliance with some demand a person would threaten to commit suicide or to kill one of his own children unless his wish was granted. All such practices are forbidden by the Indian Penal Code.

An identical custom once prevailed in Ireland, and is frequently mentioned in the Brehon laws. It is recorded that St. Patrick "fasted upon" Loegaire, the heathen over-king of Ireland, until the latter embraced Christianity, and in accordance with the superstitions of the times the king and his family felt it incumbent upon them to fast at the same time until this test of endurance was won by the saint.

Vegetable Hair Industry of the South

Vegetable hair or so called Spanish, long or black moss is an epiphytic plant growing on a good many different kinds of trees in the southeastern United States, West Indies and South America. The largest and most tenacious kind grows on the bald cypress in the South Atlantic and Gulf States. It is known botanically as *Tillandsia usneoides*. The specific name *usneoides* means "like *Usnea*," a generic name of a gray lichen or so called "moss," which is common along the coast as far north as New Jersey, and which it resembles, but to which it is in no way related. The common name "moss" is a misnomer for the plant, because it is not a moss at all, but belongs to the pineapple family of plants (*Bromeliaceae*). While this plant grows upon another, it does so without deriving any nourishment from its host as does a parasite. It is more of the nature of an air plant, and hangs in long festoons from the branches of the trees throughout the moist regions of the South. It is generally considered that it does not interfere with the growth of the trees upon which it grows, except in cases where it is very abundant.

The collection of this plant is a growing industry in the South, and constitutes one of the important minor forest products, which is usually overlooked. It hangs from the branches of the trees often within easy reach, and is gathered in the time of the high floods when the swamps are easily accessible by small boats. The gathering is done by negroes at intervals of seven years on the same trees. After it is collected it is placed in large piles on the borders of the swamp, packed closely, and left to decay for about a month. During this time the linear-awl shaped leaves and the grayish, scurfy, cellular tissue surrounding the firm, hair-like elastic fiber partly rot away. It is then dried thoroughly in the open air when it loses about 90 per cent of its weight. In this state the material is shipped to small gins located in various parts along the Gulf Coast, where it is further dried, perfectly cleaned by machinery, and baled for the market. During the process of cleaning the material is washed in boiling water and soap. It is then hung out on racks to dry and finally dusted in a fan mill. In the operations of ginning and cleaning it loses about 35 per cent in weight. When the moss has passed through these processes a dark, coarse, tough fiber is left, which resembles horse hair. To impart a uniform color to the article it is sometimes dyed jet black, and the best qualities can hardly be distinguished from horse hair. It is used extensively for stuffing mattresses, cushions, and the like. It is usually mixed with horse-hair.

There are no data at hand to show the present annual production and consumption, but the value of the prepared vegetable hair in the South may safely be estimated at about $600,000.

The Current Supplement

In the current issue of our Supplement C. F. Fraser gives full directions for constructing a single phase induction motor.—Our readers interested in ethnology will find in this issue an article on Siberian medicine men.—R. D. O. Johnson tells us of a fish that prefers climbing to swimming.—C. R. Darling describes experiments with liquid drops of over two inches diameter, which can be repeated by any reasonably dexterous person.—Truman G. Palmer contributes a most important article on the highly beneficial effect produced on the soil by raising sugar beets in rotation with other crops.—The new giant steamer "Vaterland," which measures 950 feet in length and 100 feet in beam, is illustrated and described.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Crews of American Ships

To the Editor of the SCIENTIFIC AMERICAN

In the SCIENTIFIC AMERICAN of March 8th, 1913, page 223, I note an article entitled "To Upbuild the Merchant Marine," by Charles Depesse. I read the article with interest, and it contains many valuable suggestions relating to our merchant marine in the deep-sea or foreign trade I note, however, the following

"Why the management of an American steamer is compelled by law to employ only Americans, while the men that may be employed to build American steamers may be of any and every nationality, is one of those things past finding out. Whatever the reason is, the facts are there, and they add to the handicap that the American merchant marine suffers from"

I have noticed this statement at different times in articles written by different persons relating to our American merchant marine. It is true that the licensed officers of vessels of American registry are required by law to be American citizens, but this is not true of the crew, and those writing about our American merchant marine should understand this. J W ALEXANDER

Washington, D C

"The Fallacy of the Spring Wheel"

To the Editor of the SCIENTIFIC AMERICAN

The above entitled article by G F Fisher appeared in your valuable paper February 1st, 1913 It would appear that the article might in some cases discourage attempts to find a substitute in the spring wheel for the pneumatic tire, and in the writer's opinion it is too early in the stage of development as yet to curb any such attempts.

The greatest drawback of the spring wheel is not so much the work required of the springs as the objectionable effect of inertia of the rim weight and other parts of the wheel before the spring action is reached In the pneumatic tire we have the almost ideal condition in the practical absence of inertia effect because of the comparatively small mass of tire affected at any moment of the wheel turn, in other words, there is practically no weight in motion differing from the radical constant of the periphery of the tire, which results in the car weight being practically floating on an air cushion

How different are the conditions with the spring wheel! Here we have a rim and tire weight as well as a portion of the spring mechanism of possibly fifty pounds at least, which weight is wholly to be considered as outside the wheel rim so that at any fair speed the inertia of the mass and weight is a considerable quantity to raise and fall bodily over the road obstacles at a rapid velocity, in fact it is sufficient to rack a wheel to pieces.

To solve the spring-wheel problem attention should be directed toward placing all of the wheel weight possible inside of the springs and away from the rim or tire, which means that the springs must do their work as near the tread as possible, and if they are capable of acting in one segment of the rim without affecting the balance of the rim or tire the effect will be so much nearer the ideal

The writer believes a spring wheel will yet be produced that will compete favorably with the pneumatic tire, but working with hub springs and heavy rims must give way to development of peripheral springs disposing the least possible mass of the wheel rim to action.

Along these lines there is hope.

Oshkosh, Wis L J MONAHAN

The Mississippi Problem

To the Editor of the SCIENTIFIC AMERICAN

I wish to congratulate you on having brought out so many ideas on the problem of the Mississippi, and more particularly to thank you for correcting me in the matter of the bed of the stream. Theory alone will make it clear to anyone that so long as the Gulf of Mexico remains open, no raising of the bed of the Mississippi can possibly occur, levees or no levees. It is a real comfort to know that the lower Mississippi can really be controlled by the levees, and I am sure that many of your readers like myself feel that they owe you a debt of gratitude for having cleared their minds on this point.

However, I cannot but feel that your attitude on the problem as a whole is far from the correct one. It seems to me that you have confounded the real problem of the Mississippi with the problem of merely controlling its lower portion. For in your editorial you seem to have all but disregarded everything and everybody west of St. Louis. I submit that the real problem is not one of how to put mud and water into the Gulf of Mexico, but rather of how to put bread and butter into the stomachs of men; and the question is not, Can the flood waters be confined between levees? but instead, Can they or any portion of them be put to better use elsewhere?

You say that the trouble with the reservoir plan is the magnitude of the problem But there remains a lurking feeling that if the floods were over so much less in volume, you would still favor the levee system as being sufficient, and it is certain that in case the floods were many times greater, your line of reasoning would force you to declare that much more emphatically against the reservoirs. At any rate, this does not look like a question of magnitudes alone, but of principles as well No one, I hope, favors the removal of the levees, but there is certainly much that can be said in favor of assisting them with the reservoirs

First, common sense teaches that it is cheaper to build one dam across a river than to heighten two levees alongside of it, and also that a flood saved at the source of a river is a flood saved throughout its entire course

Second, theory says that inasmuch as the cost of both levees and dams is roughly proportional to the square of their height, and the benefit in the case of the levees not in a greater proportion, while in the case of the dams they may by wise selection be made out of all proportion to the cost of the dam, it would be wise to at least give the dams a fair trial

Third, the Almighty has pronounced in favor of the reservoir, as is so plainly evident in the case of the St Lawrence, whose basin covers an area forty per cent that of the Mississippi and yet whose steady outflow is less than nine per cent of the flood record of the Mississippi, a ratio of nearly five to one in favor of the reservoir plan

Finally, the SCIENTIFIC AMERICAN itself admits that a reduction of three or four feet in the height of the floods could be secured by converting the St Francis basin into a reservoir, and objects to the idea only because a good-sized State would be flooded, an objection well founded so far as the St Francis basin is concerned but an objection that would become a mighty blessing almost anywhere west of Omaha

And against all this you set up what authority? Col Townsend Under such awe-inspiring circumstances, one would feel impelled to ask with bated breath, "Who is this man Townsend?" were it not for the fact that his testimony seems to prove chiefly that he doesn't know where the water comes from!

Your attitude then Mr Editor, seems to amount to this The western man says, Give us the reservoirs. They will be a great blessing to us and a material help to the Southern planter and to river navigation" You reply, "Yes, they would help the lower Mississippi *some*, but the trouble is that they would help you *too much* and give you just what you want, namely, water area instead of parched land Therefore we cannot think of such a thing!" N J NOBLE

Noble, Alta, Canada.

Criticism of the Gear Engine

To the Editor of the SCIENTIFIC AMERICAN

I have been greatly benefited by reading your excellent journal for the greater part of my life But I am surprised beyond adequate expression at the article "A New Gear Engine," on page 249 of the issue of March 15th. If I correctly understand the proposition, and I believe I do, Fig 1 is a very old plan, in fact it is what started me on the turbine Steam will cut that device and render it useless in a very short time even if made of the best steam metal But that is not the point I take exception to It is the statement regarding the expansion, "the continuous flow against a series of pistons," cogs in plain words, aptly designated "infinite receiver" Now, if any one can find an expansive element in the continuous flow of steam into an infinite receiver I am badly off my base, but I am more than willing to learn Then on page 258 the continued article states, "as it uses the pressure energy of the steam instead of the kinetic energy" There is certainly no expansion possible in pressure energy, but under favorable mechanical conditions, "kinetic energy" can exert the limit of possible expansion. I only know of two kinds of practical confined steam expansion, viz, that beginning at the point of the cut-off in a reciprocating engine, and that secured by providing an increased diameter, or enlarged channels, as in a steam turbine Of course, an unconfined expansion would be the "infinite receiver," or more properly the exhaust. This is one of the very interesting problems that have appeared from time to time and I hope you will consider it worthy of space for discussion. GEORGE J FERGUSON

St. Louis, Mo.

New Cycle of the Gear Engine

To the Editor of the SCIENTIFIC AMERICAN

I would like the privilege of replying through your columns to the objections which Mr Ferguson, in his letter which you kindly inclosed to me, raises against your article on my gear engine. It will elucidate the subject for the general reader if his letter is published together with this reply

His misconception of the working of the engine may be due, it is possible, to the very cursory explanation of the invention which a limited space made necessary On the other hand, his assumption that there can be but two practical ways of using steam because he "knows" of no other is naïve, to say the least My cycle, I am eager to admit, does not appear in any book on thermodynamics But for what purpose do inventions exist if not to prove new theories and advance new methods?

His objections, in brief, are these First the device is a "very old plan," second, the steam will cut the metal, third, the pressure energy cannot be obtained from steam at a continuous flow

In reply to the first, I must say that the United States Patent Office differs radically in opinion with Mr Ferguson upon the novelty of the invention, and has granted very broad claims on the very uniqueness of its construction and art There are several drawings of gear engines in the Patent Office which look like this device, but in fact are very different

My answer to his second contention is that thorough tests in actual service of my gear engine since 1907 have conclusively refuted any theory that the steam might cut the metal The reason for this is a mechanically simple one, the surface of the gear travels through the center piece at a high rate of speed, and the steam has absolutely no chance to flow steadily through any small clearance between the gears and center-piece wall, while in the case of a slide valve, the steam will cut the metal because there is so little motion in the parts It must be remembered that the surface of any high-speed rotor does not remain at a fixed distance from any closely adjacent surface and the rapid alteration of this clearance assists in churning up the leakage steam and prevents cutting

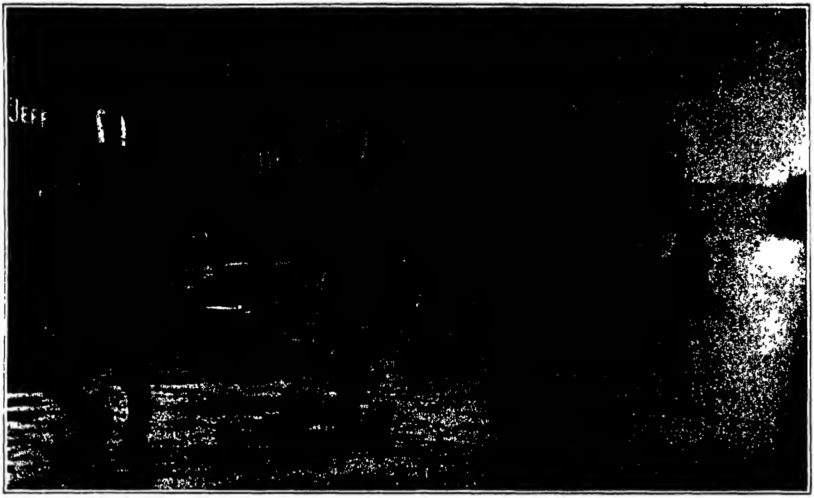
Thirdly, my critic has patently not understood what is meant by the expansion of steam at a continuous flow against a series of pistons having what is termed an infinite receiver between them The term "infinite receiver" does not refer by any means to the series of spaces between cogs in a single-stage engine, but to the chambers which inclose respectively the successive pairs of gears in the multistage unit An infinite receiver is commonly accepted to mean a receptacle of any size wherein the temperature and pressure of steam is constant Therefore the several stages of a multistage gear engine or multistage turbine are properly designated infinite receivers inasmuch as the continuous flow of steam within each stage renders any change of temperature or pressure inappreciable

I doubt if Mr Ferguson has grasped the principle moreover, upon which the steam acts in this engine The steam is admitted above or below the intermeshing point of the gears according to the direction in which they are meant to be propelled, and being confined by the center piece, forces the teeth away from the intermeshing point by pressure energy, precisely as against a piston It does not act with an impact, such as with turbine blades The work done by this first pair of gears corresponds to the work done in a cylinder engine up to the point of cut-off, and it is by combining with one or more additional sets of gears having teeth of increasing area, that the expansive power is obtained In a piston engine the internal energy of steam is utilized expansively as *pressure* against the piston after the point of cut-off, in a turbine, in the form of kinetic energy while the steam is working in a *continuous flow* My multistage gear engine utilizes the *pressure* energy of steam while expanding it at a *continuous flow*

The best experts on thermodynamics acknowledge that the use of such a cycle is new and has many advantages over cycles now in use My critic will please note that Prof Parr of Columbia was quoted thus in your article "The advantage of this cycle lies not so much in the cycle itself as in the form of the machine which the cycle permits to operate upon it It is the very high percentage obtained (at the brake) of the theoretical work of my cycle that enables the water rate of this engine to be excellent, although the cycle itself is not claimed to be, in a limited number of stages as ideal as the Rankine Using dry steam from 100 pounds gage to atmosphere, the efficiency of my cycle for one stage is 40 per cent of Rankine two-stage 69 per cent, three-stage 77 5 per cent, four-stage 81 per cent, eight-stage 91 per cent etc In an infinite number of stages my cycle equals the Rankine cycle, even though the steam does not at any time expand adiabatically

But while in the single-stage my cycle is only 40 per cent of the cycle upon which all other types of engines work (the Rankine), nevertheless the tests show the water rate obtained from this single-stage engine is better than those of the average piston or multistage turbine of equal horse-power It can be readily seen that a multistage gear engine with its tremendously increased cycle efficiency should equal, even in small units, the economy of the largest turbines now in use

New York city C H CLARK.



Launching a motor boat at Dayton, Ohio, to go to the rescue of flood victims.

The Recent Great Flood

What May be Done to Prevent Such Inundations in the Future

(Photographs by Underwood and Underwood)

DURING the latter part of March and the early part of April of this year the Ohio River system was visited by the most remarkable flood in its history. The successive phases of this occurrence were as follows:

(1) Torrential and long continued rains over the north-central watershed of the system, dating mainly from March 23rd. At many places the rainfall was without precedent. Thus up to the morning of the 27th Bangorville, Ohio, had a total of 9.50 inches (the normal rainfall for the whole month of March at that place is 3.83 inches); Marion, Ohio, 10.60 inches (normal for the month, 3.51 inches); Bellefontaine, Ohio, 11.16 inches (monthly normal 3.79 inches). Eye-witnesses describe the rain as coming down in solid sheets, as in a cloudburst. Previous conditions were not especially favorable for floods. River stages were not high before the great rains began. There was no snow on the ground, to cause by its rapid melting the sudden swelling of the streams, as so often happens in spring freshets, and lastly the ground was not frozen—a condition that prevents the rain from soaking into the soil and thus increases the percentage of run-off. Nevertheless, the rivers of southern Ohio and Indiana experienced the worst floods on record in that section. Flood warnings were issued from Columbus by the Weather Bureau on the night of the 24th, a few hours before disastrous conditions began. No one, however, could foresee the magnitude of the visitation. While flood prediction for such rivers as the Ohio and the Mississippi is comparatively easy, with the present elaborate system of river gages and rainfall stations, and becomes more and more accurate with increasing distance from the headwaters of these rivers, no means is known to science of giving timely and accurate warning of high stages in the smaller tributary streams. The weather map is an uncertain guide, for while, on the one hand, with the prevalence of certain types of weather the forecaster can be certain that floods will *not* occur, with other more or less frequent types there is always danger of floods, but the danger is not so clearly indicated as to warrant the forecaster in alarming the community with warnings that, nine times out of ten, would not be verified.

Life lines strung across a Dayton street to save persons floating down on wreckage.

Woman and child rescued from their home in the flooded district of Albany.

(2) By the morning of the 26th the rainfall area had spread to the southern watershed of the Ohio, and also to the headwaters above Pittsburgh. Thus from north, south and east huge volumes of water were pouring into the main river, along which flood stages were soon exceeded. The flood on the Ohio, although attended by stages exceeding at some points any ever before recorded (at Parkersburg the previous record was exceeded by 5 feet), entailed little if any loss of life, as its occurrence was foreseen in good season. A high water crest normally takes a day to travel from Pittsburgh to Wheeling, another day to reach Parkersburg, three days more to reach Cincinnati, and six days more to reach Cairo. These figures are considerably modified by the compounding of wave-crests from tributaries, but they illustrate the fact that the movement of a flood along a great river is relatively slow, and if the forecaster knows in a general way the conditions over the tributaries he can predict river-stages from day to day at down-river points with considerable accuracy.

(3) On the morning of the 27th rain or snow was still falling over the whole watershed of the Ohio and throughout the northeastern States. Serious floods occurred in several sections outside of the Ohio system. The James River, at Richmond, reached 17.5 feet (7.5 feet above flood-stage) on the 30th. Floods were widespread in the State of New York. At Albany on the 28th the highest stage ever

previously recorded was exceeded by 1.2 feet, at Schenectady by 3.5 feet. On the 27th the weather cleared up all over the eastern States.

(4) At the beginning of April the center of interest shifted to the lower Ohio, where the flood proceeded normally, as there were no further rains of any consequence to complicate the situation.

From the foregoing summary it will be seen that of the four periods into which this series of floods may be divided, only the first was particularly striking and sensational. It was attended by a great loss of life, as compared with ordinary river floods in this country, although, according to present estimates, probably not more than a tenth as great as that caused by the bursting of the Johnstown dam, in 1889, or that attending the irruption of a storm-wave at Galveston in 1900 and almost insignificant compared with the loss of life in some of the river floods of China and the storm floods of India. It was, however—not to mention the colossal damage to property—great enough to arouse throughout the country poignant interest in the question How can such occurrences be prevented?

An enormous amount of earnest thought has been devoted to the same question in connection with earlier floods. The solution of the problem is still remote, but much has, at least, been done toward correcting erroneous ideas. Thus, it was once generally believed that floods were largely the result of deforestation. To-day the relations between forests and floods tend to become a merely academic question, or, at least, no competent student of the subject now looks upon the forest as a factor of prime importance. Contemporary opinion is perhaps best reflected in the recent "Final Report of the National Waterways Commission," which is based upon the views of numerous experts in and out of the Government service. The gist of this long report, so far as it concerns forests, is that while under one set of conditions they may exercise a beneficial influence on stream flow and floods, under another their influence is probably harmful—while the fact that they have any important influence remains to be demonstrated.

The same report discusses at great length the practicability of storage reservoirs for (1) flood prevention, (2) the prevention of stages too low for navigation, and (3) the production of power. One great obstacle to the success of such reservoirs is the fact that in proportion as they serve one of these three purposes they are less well adapted to serve the other two. To quote from the above-mentioned report:

"To obtain the maximum effectiveness for flood prevention, the reservoirs should be lowered as soon as possible after a heavy rain sufficiently to afford storage capacity to catch the water from the next storm. This means less power developed and less benefit to navigation. If reservoirs are operated primarily for navigation they are filled during the rainy season, and water is held until needed during the summer months. If, after they are filled, a heavy rain should come, they would not be in a position to catch and hold any of it, and, therefore could exercise no influence upon the flood level."

Methods of avoiding this difficulty have been suggested, but they involve reservoirs of relatively large capacity and proportionate expense. However, the whole question of using reservoirs for any of the purposes mentioned hinges upon the relation of their cost to the value of the results to be obtained, and as the country develops, this question is likely to solve itself, at least in small and densely populated river basins. This is substantially the opinion of the National Waterways Commission, which has declared that "flood prevention is primarily a local problem, and the work of controlling floods should in the first instance be undertaken by the minor subdivisions." The coordination and consolidation of such efforts will, no doubt, rest ultimately with the Federal Government.

Preparing to dynamite a jam at one of the bridges in Youngstown, Ohio.

One of Dayton's principal streets as it appeared when the floods receded.

Removing Stains from Tea Cups

TO remove tannin stains from tea cups or any other porcelain ware a pasty mixture of salt and strong acetic acid should be used. The mixture should be applied with a cloth, and after the stain is bleached out the cups washed and dried.

Cocainomania at Montmartre

THE Société de Médecine Mentale and the Société Médico-Psychologique have recently been investigating the new epidemic of "cocainomania" which has broken out in the famous Parisian suburb of Montmartre. Dr. Marcel Briand, the alienist of the Sainte Anne Asylum, has made an especial study of the question, his intern assistant, Dr. Vinchon, who, at his request, visited Montmartre to explore, gives to *Le Temps* an interesting account of the conditions, which are substantially as follows: It is all a matter of fashion and snobbery. Fashion has a great influence in the suburban life of Montmartre: everybody there is as concerned about the doing and the behavior of everybody else as if it were a little provincial town. They even have their little gossipy papers to report the doings of the well known local characters. These sheets inform you, for instance, that Mademoiselle Jane or Mademoiselle Irène has just been cruelly abandoned and is consoling herself with cocaine, or, to use the shorter Montmartre term, with "coco."

Naturally, as the poison has been spreading for some years, a considerable illegal traffic in it has come into existence, in spite of the vigilance of the police, who are almost powerless to suppress it. The cocaine is procured by the employment of prescriptions, which are shown at one pharmacy after another, or else from disreputable shops which sell the poison without asking any questions. These transactions are not conducted by the consumers themselves, but by go-betweens—touts or female attendants attached to the cafés and other resorts—who put the poison into small boxes and sell it as high as four or five francs per gramme. In the music halls one often sees young women seated at tables with a glass of port and one of these easily recognized little boxes in front of them. As the supply diminishes, late at night, prices rise and sometimes as much as forty francs is paid for a gramme of cocaine snuff—often adulterated at that. There are mysterious ways of obtaining the drug by night: for instance, you throw a pebble at a lighted window, a little basket tied to a string is let down, you put a certain sum into the basket, it is drawn up and let down again with the worth of your money—or nearly—in cocaine. At least half the women known as *femmes de Montmartre* are addicted to cocaine. One reason for the extent of the habit is the ease with which it is practised—no need of pipes, as for opium, or hypodermic syringes, as for morphine. Moreover, the desired effect is produced by the very first dose, and not after one or two experiments, as is the case with morphine.

The cocainomaniac is recognizable by several signs. The method of taking the drug induces a habit of sniffing. Eventually necrosis of the nasal cartilage sets in. The victim is subject to tremors, and searches her hands for the little creatures which she thinks she feels buried under the skin. In a more advanced stage hallucinations come on: she thinks she hears voices insulting her, and this gives rise to quarrels which end in prison. A morbid longing for rapid movement induces the victims to take long automobile rides, with or without money to pay the fare. The end of it all is the insane asylum, reached by way of the police courts.

The Singing of Telegraph Wires

AN active discussion has been going on in the German periodical *Das Wetter* as to the cause or causes of the singing or humming of telegraph wires, and the possible relation of these sounds to the weather. There appears to be a widespread belief that the singing is a prognostic of storms and rain, or according to another version of cold weather. As long ago as January, 1900, the journal above mentioned reprinted from a German newspaper an article by Dr. Kyllam of Brunswick in which the writer claimed that infallible weather predictions could be made from these sounds, the pitch and loudness of the sounds indicating how soon bad weather would occur.

The recent revival of this subject dates from a suggestion made a couple of years ago by Prof. Arthur Kidd of Ottawa (quoted in *Das Wetter* of December, 1911), that the immediate cause of the vibration in the wires was a "seismic unrest" in the ground, this in its turn being a harbinger of bad weather.

The obvious explanation of the singing is that it is due to the wind, as in the Æolian harp. It is claimed that the sounds occur when the air is absolutely calm, but of course there might be some movement of the air at the level of the wires when there was none at the lower level of the observer. Otto Meissner, who has been making systematic observations of the phenomenon during the past year, is unable to find any relation between the sounds and the force of the wind, but he does find that the direction of the wind relative to the direction in which the wires run is an important factor. His investigations also disclose the fact that the singing of the wires is by no means simultaneous at places only a few miles apart. This fact, as well as actual comparisons with seismographic records, appears to dispose of the hypothesis that the singing is due to microseisms. Meissner has also disproved the belief that the sounds foretoken bad weather.

Variations in the pitch of these sounds may reasonably be ascribed to changes in the tension of the wires with varying temperature.

A Terrific Hot Windstorm, which occurred in Tasmania January 13th, did incalculable damage to the fruit crop of that colony. In some districts the crop was entirely wiped out, while elsewhere the orchards lost from 40 to 50 per cent of their fruit.

A Narrow-gage Self-propelled Passenger Coach

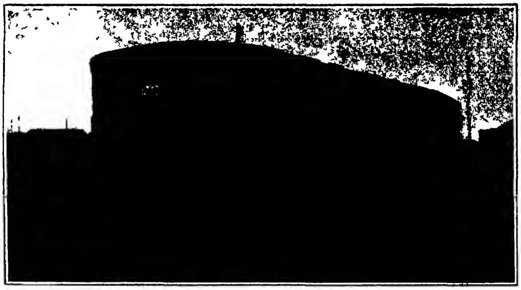
A Novel Gasoline Car with Transversely-mounted Motor

By Stanley Petman, M.E.

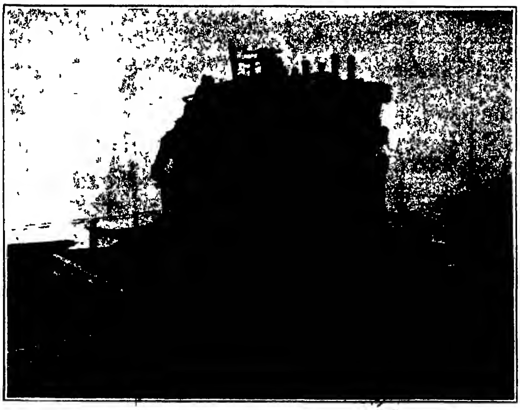
WITH the practical perfection of Dr. Rudolph Diesel's internal-combustion locomotive which already has undergone successful tests in Germany, greater attention is bound to center on the self-propelled passenger coach utilizing comparatively cheap oil fuel or even gasoline, for it has been demonstrated that the total operating expense of vehicles of the latter type employing the lighter hydro-carbons, can be reduced to nearly one quarter that of a steam locomotive with one car and half that of an alternating current coach.

Although gasoline propelled passenger coaches of standard size and gage are used to a considerable extent, additional interest attaches to the car of which a photograph is reproduced herewith by reason of the fact that it was constructed for special purposes which restricted the permissible gage to 3 feet 6 inches instead of the standard 4 foot 8½ inch gage. It is one of five recently shipped to Australia for service on the Queensland government railways, and though its principal point of difference from others of its kind lies in its narrow gage, its construction also incorporates a number of other interesting features.

Thus, for instance, the engine is placed transversely to the chassis instead of longitudinally as is the usual practice. It is a massive six-cylinder motor with a bore and stroke of 10 inches and 12 inches respectively. It drives all four wheels of the forward truck through the intermediary of a multiple disk clutch and a simple two-speed gear which permits the necessary reduction for starting and slow running. The transmission of power between the two pairs of wheels, as may be seen by the accompanying photograph, is by Morse silent type chains, and it is understood that the mechanical efficiency of the arrangement is as high as 98 per cent. The engine is rated at 200 horse power and as it is air starting and reversing, no provision for a reversing gear is necessary. The remainder of the power unit embraces 3-foot steel tired, cast steel center driving wheels carried in it by 10-inch journals. The wheel base of the trucks is 6 feet and of the complete car, 40 feet.



Narrow gage gasoline motor car for the Queensland Railways, Australia.



Two hundred horse-power transversely-mounted engine of the gasoline motor car

Another point of difference between this car and others is that the position of the operating levers has been reversed for left side control. Also, instead of the standard Master Car Builders Association's couplers a side type of buffing gear with draw hook and screw couplings is employed.

The total capacity of each car is 60 passengers, of which 65 are accommodated in the main compartment and the remaining 11 in the smoker, which is next to the operator's cubby hole. To facilitate the handling of passengers at elevated as well as at road side stations, the center entrance is depressed, the step coming very close to the ground. Artificial illumination is provided by a complete self-contained electric lighting system.

The weight of the car is 60,000 pounds and its principal dimensions are as follows: Length over end-sills, 59 feet; length over buffers, 62 feet 5¼ inches; width over sheathing, 8 feet 9 inches; length of passenger compartment, 31 feet 7⅝ inches; length of smoking compartment, 8 feet 9 inches; inside height from floor to ceiling, 7 feet 8½ inches; distance between center plates, 34 feet.

The cars were shipped to Australia completely "knocked down" and will be set up on arrival by an expert in the employ of the manufacturers.

Greenheart Timber

A CIRCULAR just issued by the United States Forest Service contains a mass of practical and very useful information on greenheart. The want of such a treatise has long been felt. Indeed, there is an urgent demand for a work furnishing full information on this wood, its availability, price and properties. Such a work, appearing concurrently with the use of this wood in the lock gates at Balboa Canal Zone, will naturally be in demand and will prove of very great value to builders, engineers, contractors of marine and naval construction, and wood users in general. This circular on greenheart is the fourth of a series of publications on the commercial woods now imported into this country. In these is condensed and arranged a large amount of useful information in a systematic and classified form. This effort of the Forest Service to diffuse information on imported woods is certainly to be commended. It is surprising how little is known generally of the various imported woods, and these publications will be read with interest by many.

The circular on greenheart is not a mere compilation of facts from unauthoritative sources, but it is a thoroughly practical work. Without professing to be a treatise on the mechanical properties of the wood, it furnishes valuable descriptive details of the gross characteristics and special information on the microscopic features, which serve in distinguishing this wood from its inferior substitutes. The various powerful tendencies of modern building and marine construction seem to point strongly toward a larger consumption of this valuable timber. It is the duty of experts to take the initiative as regards supplying a discussion dealing with the gross and minute characters of the wood, which will be of service to the wood user in determining whether the wood delivered to him as greenheart is the genuine kind. There are other closely allied trees whose woods are coming into general use but the test of years has shown that they are far less serviceable. A most accurate knowledge of the structural characteristics of greenheart is imperatively necessary to be able to discriminate between the true and the inferior allied kinds, the timber of which, notwithstanding the close specific affinity of the trees themselves, is often found to be widely different in its adaptability to a particular work or in its resistance to the ravages of marine borers or other destructive animals. Hence descriptive details and good sharp illustrations are now offered in this publication, which will render the recognition of this leading British Guiana timber safe and altogether free from difficulty.

Fuller's Earth

FULLER'S earth derives its name from its use for the fulling of cloth, but this is now its minor function. Its principal use in the United States is in bleaching, clarifying or filtering crude oils and grease. In clarifying oil the earth is first finely ground and then packed into long cylinders through which the heavy, black, mineral oils are allowed to slowly percolate. The oil which first comes out is perfectly water-clear and thin. The succeeding oil becomes yellower and yellower as the earth becomes charged with impurities until after a maximum shade of yellow is reached, the fuller's earth itself is clarified by a steaming process, when it is ready to use over again.

In clarifying vegetable oils a different method is employed. The oil is heated to boiling in large tanks, when fuller's earth is added and vigorously stirred in. The mixture is then filtered off through bags and the coloring matter remains with the earth, the oil being a very pale straw color. Our present production of fuller's earth is from [illegible] tons a year.

An Improvised Drill Press

By W. D. Graves

FOR an occasional light job a large cabinet maker's clamp and a ratchet brace may be made to serve as a very efficient drill press. A short stout wood screw or flat-headed rivet, with the point filed to a smooth conical point, serves as an end bearing for the brace spindle, while the piece to be drilled is placed against the end of the clamp screw, all as shown in the accompanying photograph.

Emergency drill press for light work.

The arrangement is somewhat awkward for one to operate alone, but if he has a helper to turn the brace while he steadies and feeds the work, it is very effective indeed.

Chipping or Dissolving Scale from Cylinders

By George Rice

THE accompanying drawings show how scale is apt to collect in automobile cylinders and accessory parts and also the tools that may be used to remove it. While some owners and repairers of automobiles take special steps for the prevention and elimination of scaly matter from the cylinders, others are very careless concerning this bothersome problem and as a result they are apt to have overheated cylinders due to the presence of the foreign matter. Of course scaly accumulations are caused by the use of imperfect water. If hard water is all that is available water softening and purifying compositions must be employed for dissolving the scale. There are patented mixtures for this purpose. Washing soda is used by some motorists with a certain degree of success.

The accumulated matter about the parts A and B in Fig. 1 was of course sufficient in bulkiness to interfere with the passages. In order to remove this foreign substance the cover was taken off and chipping tools employed for cutting off the bulk of the matter after which soda solutions were admitted into the cylinder to eat into and soften the remaining substance. In another case one of the bolt heads inside the cylinder was choked with scale as at C Fig. 2, and the bolt had to be broken out for removal, as the nut was too firmly fixed by the foreign substance to permit of turning off on the thread. In another instance the scale had gathered for a long time on the surface of a pipe joint as at D Fig. 3. In one place at E a hole was created as a result of the foreign matter gradually eating into the metal shell of the elbow. Finally when the shell was extremely thin and lacked sufficient power to resist the pressure from within, the metal expanded and broke, making the fracture as shown.

In the next four illustrations are shown some patterns of calking and chipping tools of a home-made style. You can buy your chipping tools of this kind in readiness for use in any hardware store or automobile dealing establishment. But often specially forged tools are wanted. You can get the tool steel blanks and have the chisels forged as wanted and to the pattern required.

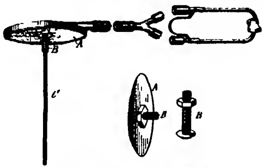
Fig. 4 is a calking tool with a 30-degree nose and from this slant you can get any degree for the bevel as may be desired for the special service to which you intend to put the chisel. A common form of effective chipping chisel for removing scale from cylinders and pipe surfaces is shown in Fig. 5. A handy cutting tool for chipping into the scaly matter in crevices is shown in Fig. 6. The form in Fig. 7 is useful for the average cutting service on scale formations.

Fig. 8 shows a gathering of scale on a pipe and Fig. 9 an accumulation about one of the check valves. The holes g and h are the result of the foreign matter slowly but surely weakening the metal by eating into the fiber and destroying it. The thinned surfacing cracks at slight pressure and a hole results. The best way is to examine the parts of the mechanism liable to be coated with scale from the water and take steps to prevent the accumulation of the substance.

Altering a Stethoscope to Locate Motor Knocks

By William R. Inghram, M.D.

EVERY physician has a stethoscope. Nearly every physician has an automobile. The stethoscope detects an abnormal heart sound and with a slight variation this same instrument detects an abnormal motor sound just as surely.

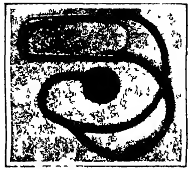


Details of the altered stethoscope

This is how the writer did it. A new diaphragm is made from a thin piece of hard rubber (an old slide from a photographic plate holder in this case). A brass dry battery bolt cut off to about ⅜ inch and with a hole drilled in the end is placed in the center of the disk and the nut is tightened up.

In the accompanying drawing A is the diaphragm, B the battery bolt and C a heavy wire threaded or otherwise fitted into the hole drilled in the bolt B. A jointed brass cleaning rod for a 0.22 rifle is just the thing.

The device is now ready for use. Place the tubes in the ears and tap the rod lightly with the finger nail. If a spring brass wire is used it will sound like the ringing of church bells. The ticking of a watch placed on the floor is plainly heard through the wire. A very slight knock in the motor scarcely heard with the unaided ear sounds like a heavy hammer blow through this instrument.



Stethoscope altered to locate motor knocks.

A valve gear knock is easily traced to its source by trying one valve after the other. Simply place the end of the wire against the valve lifter housing.

Sitting in the moving car with a long wire in the stethoscope projecting through a crack or hole in the floor and resting on the differential housing or transmission universal joint housing, or wherever suspicions indicate a knock, squeak or grating is easily traced.

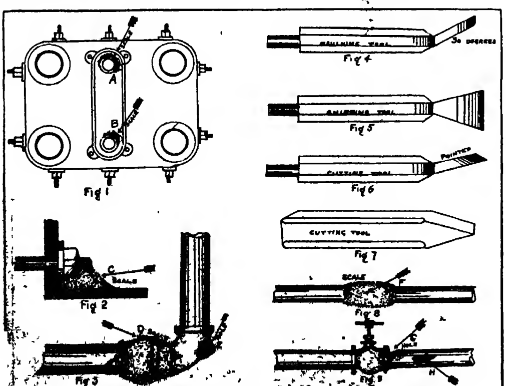
Convenient Wood Steaming

By O. Ruehmer

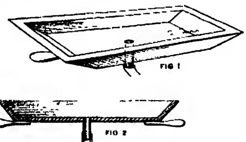
THE following device for steaming planking on the hulls of small boats will be found very efficient.

A box is constructed of light wood or metal of the shape shown in Fig. 1. The open end should be about 12 inches long and of a breadth not greater than the narrowest part of the plank to be bent. The depth is about 4 inches and at the center of the bottom a short piece of iron pipe is secured, to one end of which a hose is attached. A pair of handles can be placed on each side of the pipe to facilitate handling. The edges of the open end should be covered with cloth loosely nailed or if preferred weather strips can be nailed on the sides so as to form a tight joint when the whole is pressed up against the board. The board to be bent being in place as shown in Fig. 3 a sling is placed over the end and a stick inserted in the sling to form a tourniquet with which the end of the board may be pulled. Now by applying the steaming box as shown and attaching it by means of a hose to a boiler or kettle the plank is easily bent and the tourniquet tightened.

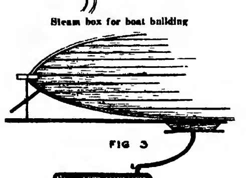
There should be no hurry in moving the box as every part of the plank should be steamed in order to obtain a true curve. A pulley fixed on a firm support can be used instead of the sling. As the planking on the sides of a boat tapers from the center to each end the box as stated should not be wider than the narrowest end. In order, therefore, to get good results when working on the wider part it will be necessary to keep moving the steaming box up and down.



Scale accumulation and tools for removing it.



Steam box for boat building



Method of using the steam box.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Power Truck Emancipates the Baggage Man

By Joseph B. Baker

AT railroad stations and shipping wharfs, the terminals of powerful steam transportation, the handling of freight and baggage by hand labor presents a remarkable inconsistency The mountain of baggage from an arriving passenger train for example, has hitherto been trundled a few pieces at a time on an ordinary hand baggage truck" At the steamship dock the cargo is slowly and laboriously loaded and unloaded by a swarm of human workers each transporting a load of scarcely his own weight

The need of some more efficient means of handling freight on platforms and docks and in the shipping departments and shops of industrial works as well, is met in the electric platform truck, replacing the laborious hand-operated truck This sturdy, powerful little storage battery vehicle is emancipating the baggage man stevedore and factory laborer Instead of pushing like a pack animal a few trunks or packages of freight the operator of the power truck stands or sits at the steering wheel guiding many times the former load to its destination with no dependence on human muscle and with great saving of time

The several different types of electric platform truck now coming into use include three-wheel and four wheel vehicles with rubber tire wheels driven through sprocket wheel and chain or through gears The compact storage battery constituting the motive power is slung beneath the platform of the truck, leaving the platform clear for its load and entirely flush except for the steering post at the front or rear end. One three-wheel truck with steering wheel in front, used on a new New York freight pier, weighs 2 650 pounds empty and occupies a platform space of 4 by 10 feet. It can run eighteen miles on one charge of the battery at a speed of 4½ miles an hour, carrying a load of 2 tons. A type of four wheel truck, somewhat larger and heavier is a double-ender, built like joining two of the three-wheel trucks back to back, that is, with the four wheels arranged at the corners of a diamond figure The truck is built in two halves, connected by a hinge joint in the frame over the driving axle, a construction which allows either of the driving wheels to drop into a rut or ride over an obstruction without straining the vehicle when loaded. The steering gear operates both the front and rear wheels, enabling the truck to turn sharp curves. The low platform baggage truck shown herewith is one of a considerable fleet" now in use at the Pennsylvania Railroad Station New York, effecting a saving of about 60 per cent as compared with hand hauling.

The usefulness of these platform trucks depends largely on their ability to maneuver in a small space as in threading their way in and out of freight cars and the aisles of a machine shop. The ordinary four wheel truck, steered by turning the two front wheels, has a radius of action equal to twice the wheel base If the truck is built to steer with both sets of wheels the radius of action is reduced to about equal the wheel base An especially powerful truck drives and steers all four wheels, and another type, designed for working in very close quarters, drives all four wheels and steers all four with the further refinement of turning each wheel so as to be truly tangent to its track on curves and reducing the radius of action to about one half the wheel base. An advantage of this arrangement is graphically shown in the annexed diagrams showing the radii of action of the three different constructions. The arrangement shown in Fig. 2 gives remarkable mobility, enabling the truck to be turned completely around in about its own length and to approach a loading platform sideways. Narrow spaces can be entered, and it is easily possible to go into a box car, proceed to either end and back out.

Power truck carrying castings in a railway repair shop.

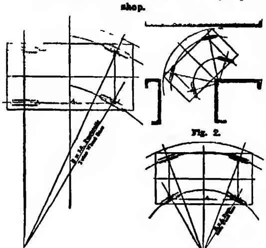


Fig. 1. Fig. 2. Fig. 3.

Fig. 1.—Two wheel drive and steer; radius of action twice the wheel base Fig 2.—Four wheel drive and four-wheel steer, radius of action about half the wheel base. Fig. 3.—Two wheel drive and four wheel steer, radius of action about equal to the wheel base

Diagrams showing maneuvering ability of platform trucks with different steering and driving arrangements.

Gasoline-driven rock drill.

Gasoline Rock Drill

ILLUSTRATED herewith is a rock drill consisting of a two-cycle gasoline engine whose piston constitutes the hammer of the drill. The hammer is acted on directly by the 800-pound explosive pressure, and when it strikes a blow on the shank of the drill steel it is absolutely free from all connected parts of the machine In fact, it strikes the same blow as an air drill which has no crank-shaft The piston is returned by energy stored in a flywheel, and is picked up for the return stroke on a cushion of air At the same time the drill steels are automatically rotated by chain and sprocket connection with the crank-shaft operating through a worm to reduce the speed of rotation. The drill steels may be either hollow to admit water and some of the explosive pressure for the purpose of removing rock cuttings from the hole, or they may be solid, in which case they are formed with a spiral conveyor that works the cuttings out of the hole after the manner of a wooden auger The engine is of the two-cycle single acting type, free from cams, gears, push rods, etc, and may be run at a speed of 3,000 revolutions per minute There is no deflecting plate on the piston and the inlet and exhaust ports are not oppositely disposed, so that there are no leaks between the ports as in the ordinary construction

Automatically Operated Railway Switch

WHEN a freight train or a passenger local has to take a siding to permit through trains to go by, unless there is a tower man to operate the switch, it is necessary for a brakeman to go ahead and open the switch, wait until the train takes the siding, then turn the switch so that the main track will be clear, then after the express is by, he must go to the other end of the siding, open the switch by hand, wait until the train pulls out on the main track, close the switch behind it, and keep the train waiting until he has time to walk up to it, and mount the last car This calls for three stops of the train To overcome this tedious process, many suggestions have been offered. Not long ago, the automatic switch shown in the accompanying engraving was installed on a siding of the Chicago and Northwestern Railway Normally, the switch is closed unless operated by the hand lever At a short distance from the switch, there is a trip which may be operated by a roller on the locomotive to open the switch The switch is then held open by the wheels of the locomotive and the following train. After the last car has taken the siding, the switch closes automatically The roller which operates the trip is shown at *A* in our illustrations. It is mounted on the end of a plunger, which fits into a cylinder *B* The engineer may force the plunger out to operative position or retract it by turning an air valve, communicating with the cylinder The roller in passing over the trip *C* depresses it, throwing the switch. The switch is then held open by a guard *D* that runs along the track. This guard is engaged by the wheels of the train, and set in depressed position.

Fig 1.—The plunger (A) riding on the trip (C) and opening the switch.

Fig. 2.—The switch held open by the wheels running over the guard.

RECENTLY PATENTED INVENTIONS

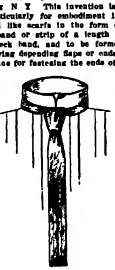
Pertaining to Apparel.

BELT BUCKLE.—E. A. GUTMAN 89 Bay 29th St., Bensonhurst, Brooklyn, N Y The invention provides a buckle having means for attachment to the belt strap to conceal the raw edge and avoid the doubling or loop of common practice; provides a buckle adapted for construction from sheet metal and provided with a bar formed integrally with the buckle frame and arranged to provide a pivot for the buckle tongue, and provides a buckle which will avoid the breaking or creasing of the enamel or finish of fancy leathers.

SHOE HEEL LIFT—E. E. LOTTIER, 805 Malone St., West Hoboken, N J This inventor provides a resilient heel having a non resilient portion adapted to hold nails or other fastening devices when driven through said heel; provides a means for securing a heel of the character named upon a shoe, and provides a resilient portion for heels, the wearing surface of which has the gripping qualities of rubber and of leather

SCARF COAT—ROSABELLE F COOPER, care of Mrs. Scully Apt. No. 102, 509 W 121st St., New York, N Y This improvement provides a scarf constructed and arranged to adapt the same for disposition as a coat, provides a garment which may, when removed be closely folded for packing or for convenience of handling, and provides a wrap garment with stays or fastening devices arranged to compel the garment to assume the characteristics of a fitted garment.

NECK SCARF.—T DEWEY and F J DEWEY Plattsburg N Y This invention is intended more particularly for embodiment in four in band and like scarfs in the form of a continuous band or strip of a length to constitute a neck band, and to be formed into a knot, leaving depending flaps or ends. It provides means for fastening the ends of the scarf

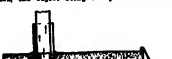


NECK SCARF

to each other and to a shirt stud or button to hold the ends in proper position The fastening means are effectively covered and concealed when adjusted so that the tie has an ordinary appearance An important object is to provide a fastening attachment which in the tying of the knot of four in hands and similar scarfs will in no way interfere with the insertion of the long end or outer flap and its movements through the knot in adjusting the latter

Of Interest to Farmers.

BROODER OR POULTRY HOUSE HEATER.—G H KICHLINE and F J STUDER, care of Old Honest Hatchery New Washington Ohio. The invention relates more particularly to a heater adapted for use in connection with brooders or brooder houses of other character, the object being the provision of a sim

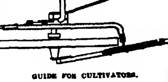


BROODER OR POULTRY HOUSE HEATER.

ple and inexpensive construction and an arrangement whereby to properly radiate the heat and at the same time prevent the fowls and young chicks from direct contact with the heater itself

INCUBATOR.—R. F TOOPE, 1 Stepney Square, Stepney, London, E., England. Incubators have generally been constructed of wood which, owing to the apparatus being constantly subjected to high temperatures, becomes exceedingly dry and liable to take fire if exposed to direct contact with the flame or a spark from the heating apparatus. There is also a danger from spontaneous ignition of the structure. The inventor obviates the danger and provides an incubator which is not only incombustible, but exceedingly durable and proof against the attack of vermin, rot, or similar causes of deterioration.

GUARD FOR CULTIVATORS.—J F REUAU, address P O., Chebanse Ill. This invention is an improvement in guards for cultivators, and has for its object the provision of a mechanism for preventing the corn from being over run by the wheels of the cultivator during the cultivation after the corn has



GUIDE FOR CULTIVATORS.

reached a certain height and in cases where stalks have been blown over or where they lean in the row which may be applied to any ordinary form of cultivator without essential changes in the cultivator mechanism

Of General Interest.

DUSTLESS CLOTH—J L. SPOSSE, 38 W 75th St. Manhattan N Y., N Y The invention relates generally to a dustless cloth and more particularly it is directed to one especially intended for dusting purposes, the principle of operation involved being new and improved and providing an article especially adapted for sanitary use.

STERILIZING APPARATUS.—J F ARMSTRONG care of L A Abrams 25 Broad St N Y., N Y This sterilizing apparatus is so constructed and operated as to cause milk to flow along a path of considerable length, and to expose said milk to the action of ultra violet light rays. It further contemplates the protection of the vapor lamp from injury by contact with the milk in consequence of certain parts of the lamp being heated

HIGH PRESSURE PIPE HINGE.—F L. McGAHAN Box 1054 Los Angeles, Cal This inventor seeks among other things of the improvement to provide a type of swivel union in which the two pipe sections, flexibly connected together may have a maximum freedom of motion and a minimum degree of leakage when subjected to high fluid pressure

BOOK MARKER ITALSA S CARSON Hyde Park Hotel, Chicago, Ill This invention is an improvement in book markers, and while the marker is capable of general application and for use wherever it is desirable to use a marker for indicating a page and a section of such page the device as presented is especially designed and adapted for use by followers of what is generally known as Christian Science

BABY JUMPER C R PATTEN Tacoma Ohio. An object of the invention is to provide an inexpensive and durable baby jumper in which the child is so supported as to permit proper exercise of its limbs without danger of its falling out and without requiring the constant attention of an attendant

FLY TRAP—J R. SMITH Stella Mo. In this trap the insects will not only be imprisoned, but will be poisoned while therein so that it will not be necessary for a person to collect them subsequently and whereby insects when dying from the effects of poison will be prevented from dropping and collecting in places causing them to become unsanitary This device therefore, combines in one structure the means for not only catching but collecting the insects.

Hardware and Tools.

CLIPPING TOOL.—W B MYERS, Rockledge Fla This invention is an improvement in clipping tools such as orange clippers, pruning shears, topping shears and the like, and the object is to provide for disinfecting the wound or cut made by the clipper Fungous diseases are transmitted by cutting implements, and the device will effectually and automatically prevent contagion

NUT LOCK.—J H WHITE, Thivener, Ohio In the present patent the invention has reference to the class of nut locks employing a ratcheted washer in connection with a grooved bolt and a nut, and a dog for engaging the teeth of the washer

BOLT HOLDER.—J T McCANA Tuolumne, Cal. This tool is for use in preventing rotation of screw bolts when nuts are being applied to them It comprises a frame having a rectangular form one arm of the same being provided with ratchet teeth, a sleeve adapted to slide on the ratchet members, and a screw supported parallel to the said member and adapted to work in the outer end of an arm which is hinged to the sleeve.

Heating and Lighting.

CAR PRESSURE GOVERNOR.—A J SHORT, 485 City road, Edgbaston, Birmingham, England. This governor is of the type in which increase or diminution of gas pressure on a diaphragm causes a valve aperture to be diminished or increased. It is applicable, more especially, to high pressure gas service mains, but may be employed on any gas distributing system.

Household Utilities.

CLOTHES PIN—H G HANSEN and C. H. FRODNER, 4315 Genesee St., Seattle, Wash The object here is to provide a pin which may be cheaply manufactured easily placed in posi

CLOTHES PIN

tion or removed from the line without the necessity of using more than one hand which will not tear the clothes either in placing or removing which does not mar the garments, and which will hold them firmly on the line without any possibility of accidental displacement

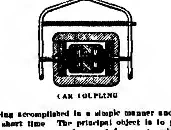
CONVERTIBLE BED AND COUCH—I MASON and J J McINTYRE, care of the former 110 Myrtle Ave., Brooklyn N Y This convertible bed and couch or davenport is arranged to permit of convenient and quick converting of the piece of furniture from a couch to a bed or vice versa, the bed and couch being very comfortable and capable of use anywhere in a room and the couch and its seat being exceedingly soft pliable and springy and its back being upholstered

Railways and Their Accessories.

CAR WHEEL AND AXLE.—J R FLEMING 801 Monroe Ave Scranton Pa The inventor provides means for holding the axle and wheels of a car in non rotative relation and provides means for permitting wheels mounted non rotatively on an axle to slide thereon within a limited area to permit the lateral shift of the wheels to accommodate the adjustment thereof to structural peculiarities of the roadbed

RAILWAY SWITCH.—J W HUBBARD, Eau Claire Wis. The invention comprises means for operating a switch and locking switch points in their open or closed position An object is to produce a construction which will prevent derailing and other accidents to trains passing the switch and for this purpose means are provided which are located in position to be engaged by the wheels of a train approaching the switch, to force the switch points over against the main rail.

CAR COUPLING.—R. ZUCKERMAN 612 Eleventh Ave New York N Y This invention relates generally to car couplers and more particularly it is directed to a construction whereby the coupling of the cars is automatically performed, the uncoupling thereof



CAR COUPLING

being accomplished in a simple manner and in a short time The principal object is to provide a coupler made up of few parts which however are adapted to co operate with one another in a secure and efficient manner whereby a new and improved structure of this class is provided

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each Please state the name of the patentee, title of the invention, and date of this paper

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents subscriptions books etc This will greatly facilitate answering your questions as in many cases they have to be referred to experts. The full name and address should be given on every sheet No attention will be paid to unsigned queries Full hints to correspondents are printed from time to time and will be mailed on request

(12774) C L. J writes in reference to query 12747 referring to patent No 871 994 which furnishes a satisfactory explanation of the reaction involved in cleaning silver by means of the aluminium-silver galvanic couple By this method the silver to be cleaned is boiled in a solution of table salt and either washing or cooking soda in an aluminium dish or *in contact with* aluminium scraps placed in a granite ware dish A galvanic battery is formed the aluminium serving as anode and the silver as cathode Nascent hydrogen is evolved on the surface of the silver and reduces any oxide or other compounds of silver to the metallic state The soda also cleans grease etc from the surface Instead of removing silver the net result is substantially one of plating on silver It is obvious that one should not attempt to clean by this method any silver articles which have been finished with an oxide surface

(12775) W M B writes I would like to say to your correspondent in Notes and Queries *G E S No 12758* that the divining rod will work in my hand The explanation is very simple and the rod is of no value in locating water The whole secret is in the way the stick is held Get a forked stick with each limb about fifteen inches long and small enough so as to bend easily Take a firm hold of both limbs, one in each hand with the palm up so the limbs will enter the hand under the little finger and go out under the thumb Now begin to explore for water My first experiment was to walk over a water pipe about six feet underground Just as I passed the pipe the end of the stick rose in the air came over toward me and pointed down and back in the direction of the running water but the pull was too strong to be accounted for by any action of the water The rough knots would have cut the skin of my hand if I had not loosened my grip I crossed the pipe repeatedly always with the same result until I tried it with my eyes closed so as not to know when I passed the pipe In this case it failed to work at all I also found that when the stick is held in any other way it will never move Held in the way directed the muscles of the hands and arms are in a strained position and the limbs are bent outward so that a very slight movement of the ends of the limbs will cause the end of the stick to move a long distance in either direction The natural efforts of the muscles to relieve the strain and the automatic action of the mind account for the working of the rod A We have known the explanation which you give of the divining rod It may be called the theory of mental expectancy It is probably as good as any theory Certainly there is no necromancy nor any occult power in water to turn the stick at least the scientifically trained man will not believe in such a power

(12776) F W G asks 1 According to the laws of gravitation two bodies A and B will attract each other in proportion to the product of their masses and inversely as the square of the distance between them if they are small spheres If a third body C is brought into the vicinity it will attract both A and B but will in no way affect the mutual attraction already existing between A and B Is this also the case if A B and C are very small spheres (in proportion to their distances) having definite electric charges? Or is the mutual attraction and repulsion of electric charges a more complicated affair? Can you recommend any book treating this in detail preferably without the calculus? A The law of gravitation is a statement which refers to particles of matter Every particle of matter attracts every other particle etc Had the molecule been known when this law was formulated probably that term would have been used in place of particle Your supposed spheres need not be large They may be large or small for what is true of the particles of a body is also true of the attraction of the whole body The same may be said of electrical charges 2 Have you any good book treating the electrolytic solution tension theory of metals? A The electrolytic tension of metals is treated in the books upon physical chemistry We can supply Van t Hoff's Theoretical and Physical Chemistry part I for $4 part II for $3 Anything by Van t Hoff upon this subject is authoritative We can send you H C Jones's Physical Chemistry for $4 This is also a good text book 3 Were any prizes or rewards ever offered for the discovery of a method of obtaining power from unorganized or low-grade heat energy as the heat of the atmosphere or the sea in defiance of the second law of thermodynamics as Clerk-Maxwell's Demon would be able to do? If so must it be done on a commercial scale or are there any other special conditions attached? A We know of no rewards for the inventing of an apparatus which should circumvent the second law of thermodynamics.

The Municipal Need of Technically Trained Men—II

By Rudolph Blankenburg, Mayor of Philadelphia

[IT is the intention of the Scientific American *to publish a series of monthly articles on the professional opportunities that await the technically trained engineer, physicist chemist, bacteriologist and technologist in modern life. Last year, it will be remembered, a series of articles was published written for the most part by well known educators connected with our leading technological institutions. They showed how institutes of technology were endeavoring to meet the requirements of great manufacturing railway and municipal corporations This year's series, written by the heads of great corporations and cities—organizations which are capitalized at millions of dollars, which employ thousands of men, and which are scientifically managed—will show how great is the need of trained chemists and engineers. The following article, written by the Mayor of Philadelphia, shows the need of technically trained men in carrying on the business of a great municipality* —Editor.]

Municipal engineering began in Philadelphia with an official who was known as a "Regulator" His principal function seems to have been to see that the rain water running off of Dietrich Hydrocrimper's lawn followed the proper course, and did not unduly disturb his neighbors. All questions affecting water courses and the laying out of roads were left to this official He worked practically without instruments

After a while the demands for improvements and supervision were such as required more technical knowledge and some few instruments were introduced and used thus the "Surveyor" made his bow From those days to this, the problems of municipal administration have been multiplying and with them increased the number of experts. It would be very interesting to list the experts of different kinds now in the employ of the city of Philadelphia We have undoubtedly over a hundred different kinds of technically trained and educated men whose knowledge of their subject has become sufficiently extended to be considered scientific.

During the past generation or two, it seems to have been one of the fallacious contentions of democracy, as we have applied it in this country that if you can get enough different people to consider and try to solve a given subject, you are then pretty sure to get a wise decision In fact, at times and especially in some localities, the thought has been encouraged that the larger the number of people who discuss a subject the more apt you are to get a sound decision This false idea, applied almost with the passion of religion to municipal administration by designing men, has held it for ten or twenty years on a very low technical and administrative level The idea was fostered by politicians who wished to keep possession of the municipal reins and purse strings for their own selfish ends. They tried to teach the electorate that if anybody who really knew anything about a municipal subject was called in to act their liberties were threatened in some mysterious way But with the tremendous increase in the size of our city and the rapidly growing percentage of our population that lives within metropolitan areas, the game has gotten too fast for a mere playground. Even the ablest and most unscrupulous of our politicians and those who are holding on tightest to their political control are to-day calling in the experts and leaning on technically trained and educated men

Probably the first notable example of this was in the development of the New York city water supply. For over twenty years that municipality has taken the position, that the water supply, first of Manhattan and later for Greater New York, was too serious a matter to be made the football of politics, and almost from the start this work has been in the hands of able men and practically free from political domination The water supplies, however, for centuries, even in ancient Rome, have been considered proper subjects for engineering schools.

The present period is remarkable in that we are beginning to look upon practically everything that is done by the municipality as an engineering or scientific problem, as we are approaching everything from a standpoint of laboratory rather than thumb rule. Take street cleaning, for instance; there is rapidly being developed a formidable literature on the subject. More and more complicated and efficient street cleaning machines are being built. The hand paraphernalia is being studied in order to make it easy to get the best results, and an enormous amount of work has been done on cost data. The control of this work has been studied both here and in Europe so as to be able to make the money expended give the best possible results. This was formerly considered a matter that was beyond the province of science or technical knowledge.

After having said all this, it is fair to add that if you ask any street cleaning expert whether any part of our present methods will be retained in the street cleaning scheme of a few years hence, he will surely reply "No." In other words, everything that we are doing to-day is so far from satisfactory that it is bound to disappear and to be supplanted by a system the detailed methods of which we know but little to-day

Another striking instance of our present day attitude is in the matter of selection of laborers. Four years ago if anybody had suggested that high-class physicians and other technical experts should be called to help solve this question they would have been laughed at. A laborer was supposed to be somebody who was just "a laborer" and no one asked any further questions. The other day, in Philadelphia, out of 450 men examined for laborers, perhaps two thirds were rejected by the doctors and others who examined them, and rejected for perfectly obvious reasons. A great many of them were suffering from hernia and other maladies which clearly showed their physical disabilities for heavy laboring. At the present time the tests that these men are being subjected to are largely physical, but now everybody admits that there are tests beyond these that must be developed if the city is to be a model employer We must be able to determine what the chairman of the Civil Service Commission has aptly designated a man's "singing qualities" that is, the relative amount of joy he has in his work A man who loves his work, no matter in what occupation, will do good work

Street lighting is just beginning to take its place as a subject for scientific inquiry on the part of municipalities. Private corporations have been collecting an enormous amount of technical data, covering at least a part of this field, but up to within the last two or three years, cities themselves have had no technical data that could be depended upon. In this field the demand has come about through the various city and State Public Service Commissions. These commissions have inquired into the technical aspects of the work carried on by different public service corporations, and they have forced both city and State to employ men competent to compete technically with those in private employ.

Sewage disposal represents an entirely different class of municipal problem, requiring scientific attack, in that it is brand new The best of these methods come from Germany, and they are the development of the last few years. The sewage disposal method which obtains over the greater part of Europe is now absolutely obsolete. Most American cities have not begun the study of sewage disposal problems.

In the past cities have had the small a number of officials with [illegible]

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY You will find inquiries for certain classes of articles numbered in consecutive order If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information There is no charge for this service *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry may be repeated

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Inquiry No. 9291 Want to buy machinery for manufacturing wooden toothpicks.

Inquiry No. 9292 Wanted a gum that will stick labels to grape-fruit.

Inquiry No. 9293 Wanted the names and addresses of manufacturers of waterproof cloth, also samples of such cloth

Inquiry No. 9294 Wanted to buy glass balls 1¼ x 1¼" in diameter

Inquiry No. 9296 Wanted name and address of some glass manufacturing company who can make patent lamps.

Inquiry No. 9297 Wanted names and addresses of manufacturers of time saving household specialties goods.

Inquiry No. 9298. Wanted the name and address of a manufacturer of [illegible]

Inquiry No. 9299. Wanted the names and addresses of concerns who can turn irregular shaped handles in wood, similar to gun-stock work.

Inquiry No. 9300 Wanted name and address of the maker of a [illegible]

[illegible]

too large a number of laborers at low compensation. The tendency has been to have too many employees at medium wage, the consequence is that the best men have gone to other employers. If the city is going to place itself in the position where it can compete technically, it must learn that men with technical skill and training are commanding increasingly high salaries in private or corporate employ, and we must be ready to meet them or lose their services. At the same time, it must learn to do the lowest grade of work with men well qualified for it and paid more than they are paid by private enterprises.

A further evidence of the interest that is being taken by technically trained men in municipal work is that a number of the different colleges are now extending courses not only in municipal administration, but in municipal engineering. The number and scope of these courses are increasing very rapidly

Efficiency in municipal government becomes more and more dependent upon men of thorough engineering and scientific training Let the cities of our country vie with one another in taking the first rank in the advance line of thought and performance.

The Cleveland Chamber of Commerce and the Oldfield Bill

[SOON after the introduction of the Oldfield Bill the directors of the Cleveland Chamber of Commerce appointed a committee on Patent Laws and Administration for the purpose of studying the operation of the present patent system and of determining the effect of the Oldfield Bill, if enacted into law, upon that system and the vast manufacturing interests of this country The report of that committee is important because it reflects the best opinion of one of the richest manufacturing districts in this country Unfortunately it is too voluminous for complete reproduction here Therefore those portions have been omitted dealing with phases of compulsory license and the attempt to make the patentee amenable to the Sherman Law, with which our readers are already familiar as the result of editorial discussion in the SCIENTIFIC AMERICAN Attention should also be directed to an excellent essay by Mr Jesse Fay, appearing in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, in which the benefits to be derived from a liberal patent system are pointed out and the difference between the patent monopoly and other monopolies clearly indicated Mr Fay's work constitutes an appendix to the following report, and should be read in connection with it.—EDITOR.]

Your committee definitely recommends that the influence and power of the Cleveland Chamber of Commerce be exercised (1) to secure the defeat of H R 23,417—the Oldfield Bill, and (2) to bring about congressional or executive action to secure immediate, competent and concentrated inquiry under national auspices, designed to lead to a recommendation and ultimate action by the proper authority upon the changes, if any, in patent or other law, Patent Office procedure and court procedure necessary to restore to an American patent under our existing complex industrial conditions and the relatively great dissemination of technical knowledge, the commercial status it enjoyed under the simpler and scientifically and technically more ignorant period immediately succeeding the passage of the law of 1836, and (3) to enlist the assistance of other chambers of commerce and other interested bodies to the above ends.

There have been introduced during the present Congress seventy-five bills relating to this subject, but not one treats it comprehensively and very few attempt to correct the abuses hereinafter cited, or increase the effectiveness of the patent system. In fact, many of the bills seem to have been designed, in effect, to destroy the patent system altogether.

Up-to-date the only bill of a general character reported by the House Commit-

tee on Patents is H. R. 23,417, colloquially known as the "Oldfield Bill," which, except for a few provisions of minor consequence, does not even profess to deal with questions hereinbefore set forth as agitating those familiar with our patent system, except in its supposed relation to the question of industrial monopolies.

Whatever view may be entertained of the community injury inherent in industrial monopolies, a proper understanding of the true nature of "patent monopoly" tends to exclude the latter wholly, or almost wholly, from any imputation of the kind. It is, in fact, more than doubtful if when the community benefit flowing from the invention is considered, the algebraic sum of the benefits and injuries which are sustained by the community from any of the existing alleged abuses arising from patent monopoly is not decidedly in favor of the community. An understanding of the true nature of patent monopoly as distinguished from industrial monopoly is so essential to a proper judgment of the entire subject that we attach hereto, marked "A," a copy of a paper read by Mr. J. B. Fay of this city in December, 1912,[1] which contains the clearest statement of this fundamental distinction which we have seen, and it should be carefully read and kept in mind in considering the various natural subdivisions of this question.

In connection with this subject, we also commend the reader to the somewhat less consistent, but nevertheless highly interesting abstract published on page 46 of the *Scientific American Supplement* of January 18th, 1913, from the late Prof. N. S. Shaler's book on "The Nature of Intellectual Property."

It is a significant fact that the better the subject is understood the less tendency there is to interfere with a patent owner's scope of action, or to fear the effect of power arising from patents. And the present sub-committee of the House of Representatives gives encouraging evidence of its intellectual honesty by being no exception to this rule. (See page 6 et seq. of a pamphlet entitled "Revision of Patent Laws," published by the Patent Law Association of Washington, D. C.)

Abuses will undoubtedly arise under any law, but it remains to be demonstrated that a limited patent monopoly of the nature contemplated by the United States Constitution and our present patent law will materially interfere with the effect of any general law in restraint of industrial monopoly or in regulation of large industrial organizations when backed by public opinion. The whole subject of the regulation of great industrial organizations and restraint of monopolies is now undergoing the most active discussion before Congress and the public, and no one would be more incompetent to predict the survivor of the many views presented and yet to be presented, and measures proposed and yet to be proposed, as he who thinks he can do it.

Instead, therefore, of enacting a law like the Oldfield Bill, fundamentally impairing the value of the United States patent inherent in the intent of the patent law, and tending to discourage financial investment in that development of invention which has played, and the great majority believe is yet to play, one of the foremost parts in the progress of our civilization, it would seem to be the better statesmanship to defer the attempt to harmonize our patent laws with the public attitude toward the regulation of monopolies, until we have found out what the latter is to be, and have had an opportunity to observe the effect thereon of the limited patent monopoly as contemplated by our present laws and to avoid injurious general legislation enacted for the purpose of protecting society against the effects of the "rare exception."

In the place of such destructive legislation there is ample room for the constructive kind. It is now over thirty-five years since the inadequacy of our Patent Office organization received official recognition, and its effect upon the pre-

[1] Published in the current issue of the Scientific American Supplement.—Editor.

sumptive validity and consequent commercial value of a patent was pointed out. It is now over twenty years since many manufacturers, attorneys and inventors, and others directly interested in, or well informed in regard to patents, began to believe that the increasing variety and correlation of the arts and consequent difficulties of classification, together with the difference between the actual and recorded states of the several arts, had passed the point at which any practicable form of organization could assure to an issued patent the degree of presumptive validity contemplated by the law of 1836, at least until the basis of patent validity, as gradually developed in the Patent Office and recognized by the public is modified to emphasize the distinction between successive inventions in the same art and between them and the actual state of the art.

But this presumptive validity of the early American patent constituted, and it is hoped can yet again be made to constitute the chief virtue of the system, and the security which it afforded to a developing investor has been probably the greatest single human factor in the extraordinary industrial, and of late agricultural development of the country and the consequent benefits which that development has brought, and has put us in a position to continue to bring, to the entire community.

In proportion as the presumptive validity of patents has grown more and more doubtful, patent property has become correspondingly more and more the object of speculation. Those engaged in legitimate industry are finding very few patents of which they can estimate the commercial value by any method short of appeal to the courts and in the great majority of cases are unable to say whether or not patents called to their attention have any value at all, or are, in fact, valid in any particular. In the period during which the full recognition of this situation was limited to comparatively few people, speculative organizations naturally sprang up for no other purpose than to make use of the large number of doubtfully valid patents for the purpose of collecting from those engaged in the arts concerned royalties carefully fixed at figures which the intended licensees could reasonably be expected to pay rather than embark upon expensive and tedious litigations, with doubtful outcome.

The pressure upon examiners and upon the Patent Office organization generally, is almost altogether in the direction of granting rather than refusing patents on pending applications. This has naturally accentuated the tendency to issue patents of doubtful validity and trivial novelty or those so slightly, if at all, in advance of 'the highest skill of the calling' as to be overtaken by the ordinary progress of the art almost immediately after issue. It has sometimes been inferred from this that it lies within the province and power of the Commissioner of Patents to relieve our difficulties by administrative reforms, such, for example as to limit the scope of patentability to inventions definitely in advance of 'the highest skill of the calling' and likely to remain so long enough after date of issue to permit the progress of the art involved to benefit enough by the disclosure and expected development of the invention to make it to the public advantage to grant in return therefor, the limited monopoly now legally provided for.

The Commissioner probably has the *legal* right to effect such reforms, but "it is not to be expected that the Commissioner of Patents can make a radical change in such practice and establish, and effectively enforce, rules which are objectionable for various reasons to a large number of persons having business with in the office. Briefly stated, simplification of methods by positive requirement of law, both as to the general patentability and the administrative procedure, is what is needed." (Quotation from page 16, "Report of the Investigation of the United States Patent Office, made by the President's Commission on

Economy and Efficiency, December, 1912." H. R. Document No. 1110, Sixty-second Congress, Third Session.)

The preparation of the document just quoted was made possible by the action of our own Congressman, Hon. Robert J Bulkley, in introducing after suitable action in committee, joint resolution No. 337, authorizing and making preparation for the required investigation leading to the report.

Again quoting from this thorough, comprehensive and intelligent report "The question of the desirability of decreasing the number of patents granted for what are called trivial inventions, so that the patents granted by the United States shall be only for inventions, or improvements that are of value is closely related to the subject of this chapter and the remedy, if one is needed, is to be found in the perfecting of the methods of examination, and in a change of law to give specific authority for refusing patents in such cases.'

But even if these objections to the practicability or adequacy of administrative action on the part of the Commissioner are insufficient, such administrative action cannot extend itself to the harmonization of Patent Office procedure with the subsequent procedure in the federal courts in case of litigation It is evident however, that any change in the character of the Patent Office organization and its legal functions will be likely to affect the degree and character of patent litigation and, therefore, affect the question of the most efficient method of court organization and procedure and that the tasks of both Patent Office and the federal courts will in turn be likely to be affected by any new legislation affecting the scope of patentability the number of patents issued, or their commercial value, and those tasks, present and prospective must determine the nature of the organization most suited to their economical accomplishment To modify one without modifying the other in harmony with it entails inefficiency and waste The efficiency of our patent system, that is, the extent to which it realizes the purpose for which it was created, depends upon Patent Office procedure, federal court procedure in subsequent litigation and the relation of the two to each other and these in turn are determined by law of Congress. To consider one without the other simply invites ultimate confusion This seems to be the inevitable goal of a thorough consideration of the subject The President of the United States, in a message to the Sixty-second Congress, Second Session (H R Document 740) on May 20th 1912, asked for authority 'to appoint a commission to investigate the present state of the patent law and to report what if any, changes, or amendments should be made, to conform that law with modern conditions and requirements."

We are not aware that any legislative action to that end has resulted, unless H J R. 337, already referred to, and limited *exclusively* to an investigation of the *administration* of the Patent Office, be considered a preliminary contribution to the desired end, as no doubt it can We are not aware that any serious, comprehensive, official attempt, is now being made to consider the several departments of this subject *together*, and to determine what, if any legislation is necessary to remove from our patent system, including court procedure, the objections above cited, and reduce every law and process relating to patent grants, or litigation, to the simplest most effective and most properly correlative form.

It is the opinion of your committee that instead of the present apparent tendency to consider piecemeal the functions of our patent system by committees whose members are actively engaged also in the consideration of other equally important, if not equally detailed questions, the whole question of harmonizing the existing patent law, administration, and court procedure with the present state of society and the arts, should be submitted to some properly constituted body, under [illegible]

tions which will permit the concentration of effort solely on this subject until recommendation is forthcoming upon which a congressional committee can base its subsequent action.

Much public discussion of this subject takes the position of, or gives the impression that the inventor or patent owner is the principal beneficiary of the patent law, which it is made to appear was devised under a constitutional provision peculiar and differing from all the rest in being designed, not for the ultimate benefit of the community, but for the benefit of a single class therein—the inventor, for whose interests the fathers of our country were especially concerned to the prejudice of the interests for the benefits of which the Constitution was framed. Such a conception is refuted by its mere statement.

It is for their *own* benefit that the people grant to the inventor a limited monopoly in return for his *disclosure* of his invention, and in order to afford developing investors reasonable security and inducement to make the necessary investment. The force of this statement "goes home" when one considers that a blast furnace for making pig iron in its commercial form costs a matter of $1 000 000, that every iron article "starts" in the blast furnace, and that somebody with the funds had to develop it. Similar instances could be multiplied. As a matter of fact there is no element of the community that the fundamental intent of our patent law would not benefit if carried out by adaptation to present conditions, and even in its present form it is a benefit to the community at large.

Respectfully submitted.

COMMITTEE ON PATENT LAWS AND ADMINISTRATION,

By HAYDEN EAMES, *Chairman.*

The "Disintoxication" of Tobacco

FOR many years Dr. Parant of Lons-le-Saunier has been working on the fascinating problem of how to enjoy the delights of a good smoke without the ill effects hitherto considered inevitable. Some two years ago he invented pipes and cigar or cigarette holders in which the smoke was obliged to traverse surfaces of considerable extent before reaching the mouth of the smoker, thereby losing perforce a large part of its toxic elements by condensation. This device, used unfailingly and regularly cleaned with care, greatly diminishes the amount of nicotine and other deleterious elements which can reach the mouth.

Now according to the *Journal des Debats* Dr. Parant has gone a step further in first aid to the smoker. His new method consists in the utilization of the catalytic properties of certain elements, especially aluminium. The tobacco is moistened with an aluminium solution, is allowed to dry, and is then smoked.

What happens? Parant's theory is that, thanks to the elevation of temperature, the aluminium which has remained fixed upon the tobacco after the evaporation, forms with the nicotine a highly instable aluminate of nicotine, which breaks up almost as soon as formed into the inoffensive substances, carbon dioxide, nitrogen and water vapor.

According to his experiments the smoke loses from 50 to 60 per cent of its normal toxic content—on the condition always, which seems to be indispensable, that the tobacco, on leaving the aluminium solution, should be dried at rather high temperature of 70 to 80 deg. Cent. When dried at a lower degree the destruction of toxic elements by combustion is much less complete.

Parant's method of procedure is very simple. In the case of tobacco it is merely moistened with the proper solution. For cigars it is better to inject the solution by means of a syringe and then dry them at slightly elevated temperature on a porcelain stove or by similar means, in order to eliminate the acetic acid employed to dissolve the aluminium in the catalytic solution.

A Real 1913 Car

Electric Lights
Set-in Dash Lights
Left-side Drive
Simple Center Control

Oversize Tires
15 Roller Bearings
50% Overcapacity
No Levers in the Way

By R. E. Olds, Designer

Here are some things which cars must have to be really up-to-date.

These are the things which you'll miss most if you fail to get them.

Note that Reo the Fifth combines them all, and combines them in an honest car.

Coming Features

Most leading cars now have left-side drive. Note that fact carefully The driver sits close to the car he passes, as in European cars.

All leading cars now have set-in dash lights, to displace the old side oil lamps.

Leading cars now employ big tires. They are costly, but the day of skimpy tires is over. They cost too much for upkeep

Mark these facts, whatever car you buy. Don't buy a car already out-of-date What leading cars do this year, most cars must do next.

Greater Care

Then leaders now are building cars with immensely greater care. They have seen that cars built otherwise don't live.

This means Timken bearings instead of common ball bearings. Not merely a couple to claim their use, but roller bearings throughout.

It means drop forgings in place of steel castings, to avoid the risk of flaws In Reo the Fifth we use 190

It means steel made to formula, and analyzed twice It means gears tested for 75,000 pounds per tooth.

It means big margin of safety Driving parts made one-half stronger than necessary

It means a $75 magneto—

A doubly-heated carburetor—

Big brakes—big springs, tested for 100,000 vibrations.

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The leading makers employ every precaution. Every part is compelled to pass radical tests and inspections

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Engines are given five long-continued tests, and the tested engines are taken apart and inspected.

Genuine leather and the best curled hair are used in upholstery, so the car won't soon look old.

Nothing is ever rushed.

Insist on Them

This is the practice in costly cars That's what makes them costly. But no man in these days should at any price buy a car without them

What pride can one take in a car with features distinctly out-of-date? What satisfaction is there in a car that's poorly built?

Soon troubles begin—soon repairs begin And the cost of upkeep makes the car a burden.

In each Reo the Fifth we spend $200 in features and cautions which some call unnecessary.

We save it in factory efficiency. By confining our output to only one model we save about 20 per cent. That's why a car, built as we build it, can be sold at the Reo price.

It means to you a long-lived car—a car that keeps its newness. It means a car distinctly up-to-date.

One wrongs himself if he lets any inducement sell him a lesser car.

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Reo the Fifth has no levers, side or center. Nothing on either side blocks the way of the driver. He is never compelled to dismount in the street, nor enter from the street

All the gear shifting is done with a center rod, out of the way. It is done by moving this rod only three inches in each of four directions. It's as simple as moving the spark lever.

Both brakes are operated by foot pedals.

This is also a coming feature. You will see why it must be. It is one you should have on a new car.

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Canadian Factory, St. Catharines, Ont.

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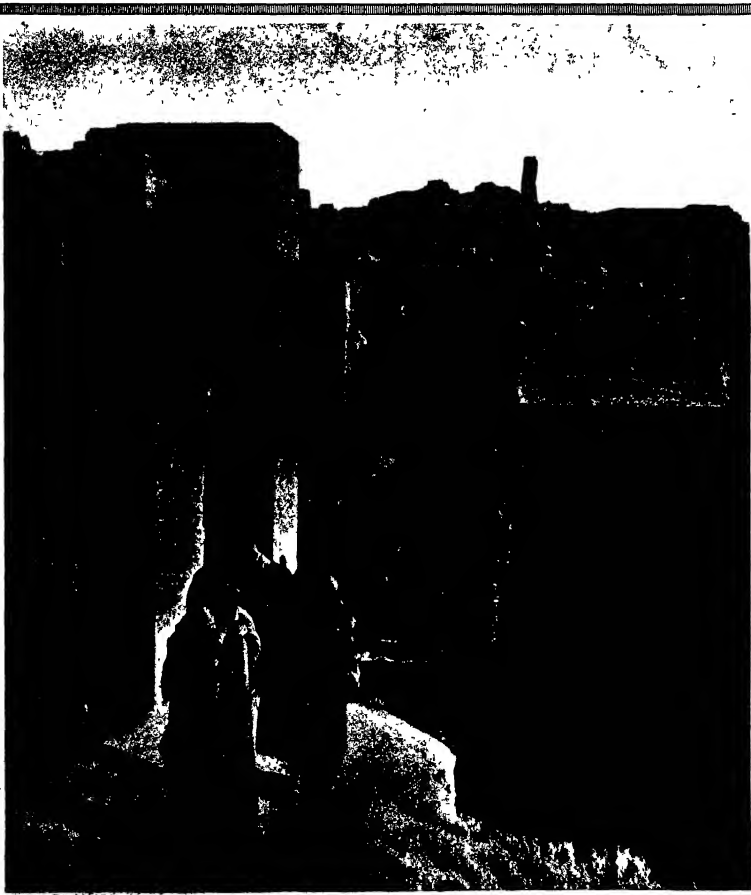

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The Triumphal Gateway of the goddess Ishtar and the processional road of the god Marduk. The gateway consists of six square pillars three on each side forty feet high and twelve feet broad. In the background is the mound of Kasr, or the royal city mound of Nebuchadnezzar

EXCAVATING BURIED BABYLON.—[See page 357.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are *sharp* the articles *short* and the facts *authentic* the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply and interestingly the world's progress in scientific knowledge and industrial achievement

Control Reservoirs and the Dayton Flood

NOTHING is more greatly needed just now in any discussion of the proper methods of control of the Mississippi River and its tributaries, than a proper point of perspective and a reasonable sense of proportion The area covered by the watershed of the Mississippi is so vast, and the localities affected by the floods are separated by such great distances, that the point of view even of the most serious and earnest lay student of the problem has been altogether too limited—too much affected by what the thinker or writer or speaker happens to see with his own eyes

In the presence of such a flood as that at Dayton Ohio we are apt to believe that the rainfall was absolutely unprecedented As a matter of fact, it is probable that from time immemorial the rainstorms of the Mississippi watershed both in the intensity and the duration of the precipitation have been just about the same as they are to-day The Dayton flood was in no sense the act of God—rather it should be termed the price which we pay in this particular direction for our modern civilization The floods are the result of the industry of the pioneer with his ax and plow and of the modern farmer and road builder, with the ditching and drainage and the constant effort direct or indirect, to get the water which falls from the clouds as quickly as possible into the river channels.

In olden days, when the districts affected by the recent rainfall were covered with dense forests, and denser undergrowth, it took from two to three weeks for the water to get into the rivers. To-day, thanks to the general clearing up and cultivation of the country the water from rainstorms of the same magnitude will be in the rivers within two or three days' time On the other hand, while the farmer has been smoothing the way for a rapid run off of the water the dweller in the cities has been encroaching steadily upon the channels which nature has prepared and found sufficient to carry the flood waters comfortably down to the sea By piling and bulkheading, areas, which properly belong to the high water channel, have been mulcted therefrom for the erection of factories, wharves and warehouses. Bridges have been thrown across the channels, frequently with massive piers and lengthy abutments, reducing the total cross section available for the flow of the water fully fifty per cent below that which nature had found to be necessary at a time when the run off of the rainstorms, to any given period of time was only from one fifth to one tenth of what it is to-day

Can the floods be prevented by reforestation? Yes—provided the farmers will vacate their lands and the Government will replant them and allow the flood lands of the upper Ohio to return to nature's wilderness conditions and if the citizens of Dayton and other towns subject to floods will blow up their bridge piers and approaches, and raze all artificial structures until the river is restored to its original capacity We are not prepared to do that of course Therefore, the only way to restrain the river under the new conditions brought about by civilization is to build levees of sufficient height to contain the flood waters and guide them safely to the Gulf Reforestation, we heartily believe in It should be done for the sake of the future timber supply of the country and it should be done on all areas which are not suitable for agriculture

Can such floods as that at Dayton be prevented by building reservoirs of such capacity as to hold back the flood waters and let them into the rivers, in such volume and over such periods of time as we might wish? Yes, the thing could be done, but it would involve an equal wiping out of cultivated lands to that demanded for adequate reforestation. Let us consider a few figures. At the height of the recent flood, the amount of water to be taken care of was such that if a reservoir of the size of Lake Erie had been available for storage, twenty four hours of that rainstorm would have caused a rise of six inches over the whole surface Think of that—sufficient water falling in one day to raise Lake Erie six inches!

Furthermore, if our Lake Erie storage basin were built to cover the area concerned in the flood of last month, it might happen that the next great rainstorm, say the following year, would fall not in the upper Ohio, but in the upper Mississippi, or in the central Mississippi or elsewhere, and our reservoir of the size of Lake Erie would be merely a costly testimonial to the fact that we had not taken a proper bird's eye view of the whole situation.

Reforestation can help a little, and reservoirs can help a little, but the true solution of the problem lies in pushing to completion an adequate system of lofty strongly built and properly reveted levees throughout the districts that are subject to overflow

Knowledge and Morals

OUR civilization has brought with it evils of its own. We teach the young to enable them to earn a living, to appreciate art and to make reasonably good citizens. But in the matter of sexual enlightenment our attitude is almost wholly negative We treat the subject as something "not quite nice to speak about" and leave the young generation to discover the truths of life at haphazard with the result that their information is gained through any but good channels. In the primitive state of society competent authorities tell us, due attention was paid to these things. We, with our higher civilization ' leave it to the coarser elements to enlighten' the rising generation while the better" elements maintain a prudish silence And thus vice is bred of ignorance

These things are not as they should be, and many voices are being raised to-day, calling for a reform of our customs. The problem is a difficult one its solution calls for our most thoughtful efforts. The phenomena of sex are so complex in their influence upon the life of body and soul, and affect so many phases of our being, that a well balanced attitude toward these things is absolutely essential if we are to escape the danger of a one sided and distorted point of view Thus, the extremist, who would elevate free love upon a pinnacle of glory, and make all things else subservient to this one principle, forgets the exigencies of practical life On the other hand, any plan which proposes utterly to disregard deep-rooted instincts of our nature can but lead to failure. In this the advocates of eugenics have shown their good judgment, that they have for the main restricted their plans to negative measures they urge us to prevent obviously undesirable unions, the marriage of imbeciles, criminals, habitual drunkards and other burdensome and harmful elements of the population. How much good such negative measures alone would do, if enforced is obvious to any one familiar with the history of such nests of vice and crime as the Jukes and Zero families. What we need is frank and sincere discussion Let not those who by their sense of the sanctity of the issues involved are best qualified to speak, be held in silence by an exaggerated or false modesty It is in this spirit that we welcome the expressions of A Jefferson Watts on the subject of 'Knowledge and Morals' in the current issue of our SUPPLEMENT

Possibilities of the Home Laboratory

IN these days of magnificent endowment, by means of which every field of science is so ideally developed and brought to fruition, one is apt to discount the possibilities of the home laboratory There may be some who are deterred from entering those Elysian fields by the reflection that isolated contributions to science would be lost in the vast output of our splendidly equipped institutions. The consideration of a few instances will demonstrate that there is no occasion for any individual enthusiast to be deterred because he may not be so fortunate as to be associated with a great scientific enterprise, given brains and industry it is amazing what can be done with a very modest equipment indeed For example

When Koch in 1882, announced his discovery of the tubercle bacillus, Dr Edward L. Trudeau was living at Saranac Lake whence he had gone to cure himself (how beneficient has the result since proved to thousands') of tuberculosis. Saranac Lake was then but a guide's settlement, remote from civilization, desolate in its surroundings, forty miles from any railroad. Dr Trudeau secured a copy of Koch's epochal paper, and, being without special training, he went to New York to receive a few lessons from a colleague in the essential principles of Bacteriology, and how to stain the tubercle bacillus.

At Saranac Lake, then, without paraphernalia other than his microscope, without access to great libraries containing manifold treatises on the subject, the water often turned to ice in his house (his wood stove would not generally burn all night, nor was there at that time any coal in that region) Dr Trudeau devised a home-made thermostat which had no regulating apparatus and was heated only by a small kerosene lamp. For protection against violent changes in temperature he inclosed his thermostat in a series of wooden boxes, the doors of which could be opened or closed at will, according to the intensity of the cold. His guinea pigs he kept in a hole under the ground, heated by an oil lamp, this being the only spot in Saranac Lake where they could escape freezing at night. (The Saranac temperatures may be lower than that which Amundsen experienced at the South Pole) Under such circumstances as these did Dr Trudeau obtain the tubercle bacillus in pure culture, being the second observer in America to do this, and with these cultures he repeated all of Koch's inoculation experiments. Since then the Laboratory of the Adirondack Cottage Sanitarium has held and holds a place in science of primary importance as to its contributions and influence

As to Koch himself At seventeen he persuaded his father to get him a microscope, as another youth might strive for a fowling piece or another for a motor car Possessed of this most congenial companion he set about perfecting other technical means of investigation. Even genius cannot work effectively without tools, so Koch himself took a hand in the making of just such tools as he wanted and needed After obtaining his degree in medicine he became a simple country doctor, utilizing his spare time (what young doctor has not of this commodity aplenty) in scientific study, experimentation, research and writing, but not until he had something to write about In those obscure years, as yet unenrolled in any world famous institution, he laid the foundation of all that noble work which earned for him the title *The Father of Preventive Medicine*

The Abbe Mendel, a simple priest, experimenting on peas in a cloister garden, evolved the most valid theory of heredity known to science The Curies revolutionized the physical sciences by their discoveries in most unpretentious laboratories. The clergyman, Spéllanzani, started physicians investigating digestion by making a dog swallow a perforated wooden ball into the hollow of which meat had been introduced, in order to learn if this is digested in the stomach by means of a ferment or through attrition by the gastric muscles. It is good for example to have richly equipped physiological laboratories, and we should be grateful for them, but their fruits come essentially from the geniuses working in them a wonderfully successful teacher of physiology got that science through even the thickest head in his classes by the agency of his personality, half a yard of string, a blackboard and some colored chalks.

The Scientific American in the House of Representatives

SPEAKING recently on the subject of the Mississippi River problem, the Hon Benjamin G Humphreys, Representative from Mississippi, included an editorial from the SCIENTIFIC AMERICAN of February 15th, 1913. The Representative said 'Mr Speaker, under the leave granted to me to extend my remarks in the *Record* I include an editorial from the SCIENTIFIC AMERICAN on the subject of the problem of the Mississippi. Since the digging of the Panama Canal this is the most serious and most important problem which Congress will have to deal with. All three of the political parties represented on this floor are committed by specific declarations in their several platforms to the task of preventing floods on the Mississippi River and I commend unreservedly to their careful consideration this editorial, which states the problem and the sole method of its solution more pointedly and concisely than I have ever seen it stated before.

"Every man here will concede that the SCIENTIFIC AMERICAN is one of the most conservative, accurate, and well advised journals on all technical subjects published in this country, and its conclusions on this particular problem will certainly carry weight, if not conviction, to every open mind. Few gentlemen here have the time which it is necessary to devote to the study of the Mississippi River, and I hope, therefore that you will read this editorial, which will cover less than two pages in the *Record*, and yet which covers the whole subject.

"Reservoirs, outlets, and other kindred theories are studied and their fallacies exposed, and the levee theory, which all who are informed on this subject agree is the only feasible way to control the floods, is fully endorsed. I do hope that every member here will read this editorial, because it illumines a subject that we will soon be called upon to consider and finally settle."

Engineering

Progress on the Cape Cod Canal.—It is estimated that the 25,000,000 tons of shipping which rounds Cape Cod during the year will be so far benefited by the opening of the Cape Cod Canal that it will be perfectly willing to pay a toll for the use of the canal. The 11,000,000 tons of coal shipped annually to eastern ports will find the inner and sheltered route of great advantage and probably the greater part of this, or such part as is carried in barges, will avail itself of the canal

Decline in Relative Strength of the American Navy—Already the United States Navy has lost the second position in rank among the naval powers. Germany has surpassed us, and now we are confronted with the probability of having to give place to France, whose navy under the new administration has taken on new life and is advancing by leaps and bounds. The relative positions of the two fleets in 1916 will be France, ten dreadnoughts, the United States, eight, France, seven superdreadnoughts, the United States, five In that year the total displacement of dreadnoughts and superdreadnoughts will be 376,000 tons for France and 310,000 for the United States.

Switzerland Buys the St. Gothard Railroad.—The acquisition of the St. Gothard railroad by the Swiss government has been advanced by the ratification by the National Council of the St. Gothard Railway Convention of 1909, by which the St. Gothard railway passes into the hands of the Swiss government. The company is paid $42,500,000 for the railroad, and in addition the government takes over the debt of the company, which amounts to $23,418,000 This line, one of the most famous engineering works in the world, was the first to introduce those famous loops built entirely within the body of the mountain

A School Which Pays Its Scholars.—For six years the apprentice school at the Lehigh Valley Coal Company's shops at Drifton has been in successful operation It is held for one hour twice a week during working hours, and a novel feature is that the scholars are paid at their regular rates for this time Attendance is compulsory for all apprentices. They are instructed in the applied mathematics of mechanics freehand drawing, correspondence, and all subjects useful to them in their craft. One of the earliest scholars could neither read nor write, yet to-day he is considered one of the best workmen in the shop The average attendance is about twenty, and the course is pronounced by visitors from nearby institutions of learning to be both efficient and complete

Over-taxation Limits Size of Cities.—In a recent issue of the *Wall Street Journal*, attention is drawn to the fact that the final determining factor in the growth of cities is the taxation, which history has shown us tends to run to very high and burdensome limits in the greatest and most rapidly growing cities of the world Attention is drawn to the fact that Mommsen has shown that the water-tax receipts proved that in the time of Hadrian the population of Rome was not less than 1,400,000 To-day it is less than 400,000, and our contemporary draws the conclusion that the people were taxed out of the city London has slowed down in its rate of growth, and attention is drawn to the fact that increasing taxation, due to the very costly works of improvement now being undertaken, may ultimately act with similar effect on the city of New York.

Sixteen-mile Tunnels Through the Rockies.—One of the most striking developments of present-day engineering is the great expense which the railroad companies do not hesitate to incur in building tunnels of unprecedented length with a view to decreasing their grades across the mountain summits The latest announcement in this connection is that of the Canadian Pacific Railroad, which states it is going to undertake the construction shortly of a tunnel that will be by far the longest yet constructed. It is to be built below its pass through the Rocky Mountains. It will be 16 miles in length and will cost $14,000,000. This is some four miles longer than the well-known Simplon Tunnel through the Alps and the estimated time of construction is seven years.

Figures of a Four Days' Rainstorm.—The Weather Bureau estimates that in the four days' rainstorm which devastated certain towns and villages in the upper watershed of the Ohio River, sufficient water fell to cover fifteen million acres of land to a depth of one foot. This represents between five and six thousand billion gallons of water In the presence of such eccentricity of nature, the works of man, whether they be restraining reservoirs or artificial banks or what not, become mere pygmies and utterly futile for restraint. A four-day rainfall which will cover such a State as Ohio with a depth of seven inches, is a phenomenon of nature which is beyond all possibilities of control by any appliances that are known in the present stage of engineering knowledge. All we can hope for is to mitigate disaster. Absolutely to prevent it would probably call for works of a magnitude which is utterly beyond our present ingenuity and resources.

Electricity

Wireless Telegraphy Across the Bering Sea.—It is reported that arrangements are being made between our Government and that of Russia to maintain a wireless telegraph service across the Bering Sea. This will complete the girdle of radio-telegraphic communication around the world.

Electricity from Sawdust.—The city of Vancouver, British Columbia, has been greatly annoyed by the smoke from sawmills and lumber mills To overcome this nuisance, a company has been formed to supply these mills with electric power As fuel for the generating plant, however, it is planned to use the sawdust from the lumber mills' waste heaps. As the power is obtained in this way from a waste product, electricity can be furnished at greatly reduced rates, and not only is the smoke nuisance abated, but the problem of disposing of enormous piles of sawdust is also solved

Threading Conduits Pneumatically.—A new apparatus has been designed for threading conduits. It has the advantage of being able to pass around several bends which would be difficult if not impossible with the ordinary fish-tape method A "traveler" is provided which consists of a series of washers loosely fitting the interior of the conduit. This traveler is connected to a string or cord which passes through a tube into a compressed-air tank where it is coiled up on a reel In service, the tank is first filled with air to a pressure of about 20 pounds by means of a hand pump, then the traveler is inserted in the conduit, the end of which is sealed by a plug on the end of the tube, and a valve is opened, permitting the air to pass out into the conduit and blow the traveler through, drawing the string with it. This string is then used to draw wire which, in turn, may be used for hauling a heavy cable through the conduit.

Sterilizing Milk with Ultra-violet rays.—The Bureau of Animal Industry has been carrying on a number of experiments at Washington, D C, in the use of ultra-violet rays for the sterilization of milk The milk is spread out in a thin layer by means of a drum revolving at high speed, which picks up the milk from one trough and conveys it to another While on the drum it is subjected to the ultra-violet rays. Then it is picked up from the second trough by a second drum and conveyed to a sterile flask A quartz mercury-vapor lamp generates the ultra-violet rays to which the thin film of milk is exposed It has been found that by this treatment the bacterial contents is greatly reduced However, when the milk is exposed for a sufficient length of time or in a film thin enough to produce a much larger reduction in the bacterial content, it is given a disagreeable flavor which renders it unfit for the market.

Electrolysis and Concrete Reinforcing—The effect of electrolysis on the iron reinforcing rods of concrete was demonstrated at the recent Cement Show in Chicago by an exhibit of the National Bureau of Standards It was shown that local currents are set up in the iron due to moisture and impurities, producing iron oxide, which, as it occupies a much larger volume than the iron, exerts a pressure that eventually results in cracking the concrete To determine the amount of this pressure, a steel cylinder with a bore of 1.5-inch internal diameter was fitted with a steel rod of one-inch diameter and the space between was filled with cement This was then immersed in water and the iron core was connected to an electric circuit. By measuring the expansion of the outer cylinder it was found that the oxidation of the iron core produced a maximum pressure of 4,700 pounds per square inch. A column of concrete, one foot long and six inches in diameter and provided with an iron core, was immersed in water and subjected to fifty volts with the iron core as the anode In three hours time the specimen was cracked A bulletin on these experiments is being prepared by the Bureau of Standards

Self-lighting Kinetoscope—By the use of a small dynamo mounted along with the crank mechanism of a moving picture machine, the Pathé firm of Paris are now able to produce a machine which is self-contained and furnishes its own current for the lamp This makes an independent apparatus which can be set up anywhere and is at once ready for use Where a current supply is not at hand, this will be very convenient. The idea is being applied in a simplified apparatus of recent design, and it is intended to be used extensively in homes or schools, as the picture machine is now recognized to have an educational value, besides giving recreation One point which lessens complication is the use of an over-volted metallic filament lamp, and by increasing the current much above the standard the lamp gives a very bright light, thus projecting a good image on the screen. Such a lamp will burn for 8 or 10 hours and can be replaced very cheaply Thus the usual arc lamp, which amateurs may find more difficult to work, is not needed here. The new machine also has incombustible films of prepared celluloid, of somewhat smaller size than the standard. In this way the machine is well within the reach of amateurs, as now there is scarcely anything to be attended to.

Science

The Tercentenary of Logarithms.—The Royal Society of Edinburgh is planning to hold an international mathematical congress in June, 1914, to celebrate the tercentenary of the publication of John Napier's "Mirifici Logarithmorum Canonis Descriptio" The entertainments will include a garden party at Merchiston, of which Napier was laird

The Names of the Minor Planets, or Asteroids, since the number of known bodies of this class began increasing by leaps and bounds, with the introduction of photographic methods of search, have furnished astronomers with the opportunity of commemorating all sorts of persons and things mythical and otherwise One of them, No 594 has just been named Mireille after the heroine of a celebrated Provençal poem by Frédéric Mistral. This name was proposed by Camille Flammarion (of course!) and has been accepted by Dr Max Wolf who discovered the planet in question in 1906

Meteorological Work of the "Scotia"—In connection with the forthcoming ice-patrol of the North Atlantic which is being organized by the British Board of Trade and several steamship companies, it is announced that the vessel to be used for this purpose the "Scotia" will carry a trained meteorologist, and that upper-air observations will be made by means of kites and kite-meteorographs which have been supplied by Dr Assmann, director of the Lindenberg Observatory It is also announced that the wireless equipment of the vessel has been furnished free by the Marconi Company Two wireless operators will be carried The vessel will be stationed off the east coast of North America to the north of the usual shipping routes, to watch the break-up of the ice and report on its movement toward the shipping routes

A "German-South American Institute" has been founded, with headquarters at the Technical High School in Aix-la-Chapelle, for the purpose of furthering both intellectual and commercial relations between Germany and Latin America The ambitious programme of this institution includes the interchanges of literature especially periodical publications the publication of directories and handbooks for the countries concerned the preparation of German, Spanish and Portuguese editions of appropriate works on the arts and sciences, and so on The Institute will be divided into a large number of sections according to countries and subjects, and each member will affiliate with one or more of these Further information on this subject may be obtained by addressing the "Geschaftsstelle des Deutsch-Sudamerikanischen Instituts, Kgl Techn Hochschule, Aix-la-Chapelle, Germany

The Highest Mountain Climb.—The account of the Duke of the Abruzzi's expedition to the Karakoram and Western Himalaya in 1909, just published reports some remarkable altitudes attained by the party According to the *Geographical Journal*, the Duke undertook this expedition chiefly to contribute to the vexed problem as to how high it is possible for human beings to climb He and his guides, after living for 37 days at or above 16,000 feet, spent another 17 above 18,000 feet, of which 9 were spent at or above 21,000 feet In an attempt on Bride Peak, the party camped at 22,483 feet and the next morning climbed to 24,600 feet thus carrying the "man-level" 700 feet higher than any previous mountaineer Only a heavy mist prevented them from reaching the summit (25,110 feet) The most remarkable part of the story is that the party did not suffer from mountain sickness, and were little the worse in any way for their exertions Apropos of this fact an interesting series of letters on the subject of mountain sickness from correspondents in various parts of the world has been appearing for some months in the *Geographical Journal* There are few subjects on which opinions differ more widely

Primitive Art.—The numerous discoveries in the way of mural paintings and drawings of paleolithic caverns which have been made in Europe of late are well *resumed* and illustrated in the recent publications made under the auspices of the Prince of Monaco and the two volumes relate to pictorial art of the epoch known as Magdelenian. The first discoveries made at Altamira, Spain, in 1872, were followed by many others and these confirmed the existence of a quaternary art of remarkable value. Systematic researches in a great number of caverns showed that this art was spread over other regions, for instance in France, where M Riviere published the drawings from the La Mouthe cavern in the Dordogne region Handsome and large-sized polychrome frescoes then came to light in the Cumbarelles and other caves which belonged to the same family Then a careful study of the subject was taken up and the publication decided upon owing to the Prince of Monaco's liberality Messrs. Captan, Breuil and others who were active workers, now determine the form and position of the caverns, then give a description of the ornamentation and draw a parallel between the animal forms and those of existing animals or of animal remains which we possess.

English Multicycles for the Blind

By Frank C. Perkins

THE first multicycle used by the pupils of the Royal Normal College for the Blind was a Rudge Sociable cycle which Sir Francis Campbell obtained. When the double Sociable was developed two of these machines were obtained in 1884 and with two sighted persons to steer the blind pupils often went on short trips. Sir Francis soon exchanged this Sociable for a tandem and had two other tandems joined for a four-in-hand.

As it was important to have a machine on which one sighted person could steer for more than three blind riders, the multicycle manufacturers were asked to construct a machine to carry eight, and a number of experiments in couplings were tried. Sir Francis with his son and a practical member of the staff of the College for the Blind made several visits to Coventry to test the experimental machines. Finally a satisfactory one was built in 1888 and given to this College for the Blind through the help of Mrs. W. W. Astor, Mr. John Cook and the principal.

The institution was soon provided with an addition of two six-in-hands, a four and a three so that a party of twenty-seven blind people could be taken out for an afternoon run. The Singer military multicycle was then developed and a twelve-in-hand was built for the Royal Normal College for the Blind in 1893, and that machine is still in use. It has six pairs of wheels with two riders for one axle and the six parts are connected by swivel and knuckle joints.

The latest multicycle seen in the photograph is very sensitive to the steering done by the second rider and it will turn in its own length and can be divided into two sixes or three fours. Its length is 28 feet and it is geared to 51. With this multicycle runs have been made to Derby, Birmingham, Brighton and other towns. Until the motor traffic monopolized the roads, the machine was in constant use by the blind boys and girls and there was no outing they enjoyed more than a run on the Brighton road. There is a track of three laps to the mile in the grounds of this asylum for the blind, where the pupils practise.

For recreation at the Royal Normal College and Academy of Music for the Blind at Upper Norwood, London, England, a number of these college multicycles are used as shown in the accompanying photographs. A team from this institution for the blind rode from London to Brighton and back, a distance of 100 miles in 10 hours 45 minutes running time. The riders for this trip were chosen from 60 candidates. The length of the machine is 28 feet and the gear is 51. The second person steers this machine and the others simply propel the combination vehicle.

Two "Sociables" connected in tandem

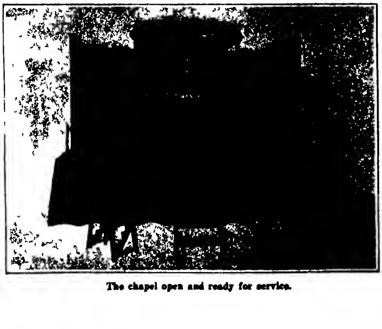
A party of blind students off for a trip on a twelve-seated multicycle.

A Chapel on a Motor Truck

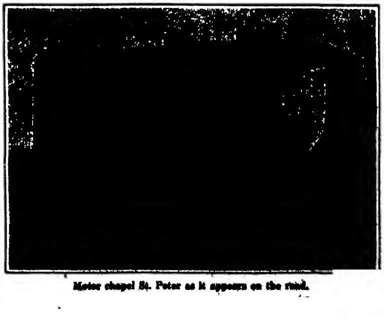
CHAPELS on wagons, on railroad coaches, on boats—we have heard of all of these, but a motor chapel—this is something new. Motor chapel St. Peter, it is called and it was presented to the Catholic Church Extension Society by a member of a western branch of the Woman's Auxiliary. It will be used to penetrate sparsely settled regions that are beyond the reach of the railroad. Starting from Brownsville, Texas, the chapel in charge of two priests, will work its way along the Rio Grande River westward through the State.

Mounted on a standard two-ton motor truck chassis, is all the necessary religious equipment. When the car is *en route* its somber gray finish the eight cathedral windows with a cross design in the center of each and the coat of arms of the society will distinguish it from commercial vehicles and give to it an appearance of individuality. When the car stops at a place for services, the rear door and hinged panels at the side open out and a drop platform is spread down giving approximately double the floor space thus forming a sanctuary of ample size. In the center of the platform extension is set a quartered oak combination altar and vestment cabinet with its ornamental brass accessories. Along the outer edge of the platform brass standards are fitted and provided with heavy silk cord guards. The floor of the platform is covered with a deep green Brussels carpet, and a green draped curtain hangs from the platform to the ground. To the right of the altar in one of the photographs may be seen a small folding organ, while in the foreground is a rack fitted with large tubular bells for outside use and a small chime for use at the altar. The equipment also includes a stereopticon, the power for the lantern being supplied by an electric lighting system, with which the car is completely provided. As a shelter from rain or the heat of the sun, a 20 by 30-foot gable roof tent with 7½ foot walls is furnished. When not in use, this is folded up and carried on the roof of the car.

Living quarters for two priests are provided in the forward end of the car. When the altar is not in use it is pushed to the extreme rear of the car, giving plenty of room for living quarters. In this forward space are contained lockers for personal effects, lockers for folding cots, bedclothes, drawers for books, stationery, a typewriter, cooking utensils, tableware, and a light supply of provisions. As many as three cots can be erected in berth style, suspended by means of brass chains, so that the priests and a chauffeur may be accommodated. In addition to this there are two extra army folding cots for use, when desired, outside of the car.



The chapel open and ready for service.



Motor chapel St. Peter as it appears on the road.

The Good Roads Movement

THAT there are upward of $400 000 000 of good roads bonds issued and outstanding is indicated by the Goods Roads Year Book of the United States, the 1913 edition of which has just been issued, containing a *résumé* of the whole road situation. It is evident that whatever may be the faults in methods of construction and maintenance, money is being spent in sufficient amount to bring about a vast improvement in the public roads. The Year Book shows $137 000 000 of State and road bonds authorized, and $156,500,000 of county bonds outstanding on January 1st 1913, making a total of $293,500,000. As this is based on reports from about 75 per cent of the counties in the United States, and as a large number of the individual townships have not reported, it is estimated that the amounts not reported would run the aggregate up to probably $350 000 000 to which should be added ten or fifteen million dollars of the bonds voted in 1912 which have not yet been issued.

Gratifying progress in road construction during the past few years is indicated by the statement in the Year Book that while the percentage of all road improvement in the United States at the close of 1909 was 8.66 per cent, the revised statistics to December 31st, 1911, show an improved mileage of 10.1 per cent, or a net gain of 1.44 per cent. This does not sound so impressive in terms of percentage but it means that in the two-year period more than 34 000 miles of improved roads were constructed or 10 000 miles more than the entire mileage of national roads in France.

The Ghent Food Congress

AT the Ghent International exposition which opens in April there will be held a Congress of food adulteration and like subjects. An interesting feature is a section where will be exhibited natural products in raw and purified state along with imitations or different kinds of adulterations. Model laboratories where food products are manipulated will also be seen by the public. Numerous lectures illustrated with lantern or moving picture projections, form another attractive feature.

Premature Explosion of Shells in Three-inch Field Guns

PICTURED herewith is a three-inch gun of the field artillery of the United States Army, which exploded when being fired during target practice near Tobyhanna, Pa., on last October 4th. This gun was made of high carbon steel, of which material most of the field guns of our service are made, and was of the built up high power variety, the principal parts of which consist of a tube, jacket, locking hoop and clip.

These guns have a total length of 87.8 inches and weigh about 800 pounds. They fire a 15-pound shell and have a muzzle velocity of 1,700 feet per second, a maximum range of 6,500 yards, or about three and seven tenths miles, and are designed to stand a maximum pressure of 33,000 pounds to the square inch.

Fortunately none of the officers or men attached to the battery was killed by the bursting of this gun and none seriously hurt, which is but another of the mysteries often accompanying the exploding of ordnance, for the gunner whose seat is on the left of the breech and directly under the rupture had just left his seat and sustained only slight injury from flying splinters. No. 1 man of the gun crew whose seat is on the right of the breech was in that position and escaped unhurt.

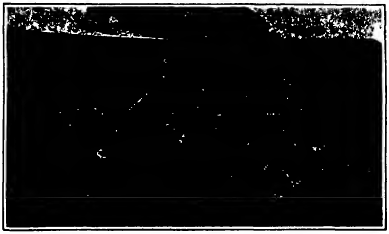
At the time of the explosion the gun was loaded with a high explosive shell containing what is known as "D" powder and was backed by the usual charge of approximately 24 ounces of nitrocellulose powder.

When the gun was fired the breech block was blown 90 feet to the rear (barely missing a soldier who was holding a horse) and the whole of the rear body of the gun was blown open on the left underneath for a distance of about three feet. When examined after the explosion the forward or point end of the shell was found to be in the bore of the gun, near the muzzle and a piece of the base was jammed at a decided angle in the bore about 50 inches from the breech.

Another more serious explosion is also illustrated herewith. It took place during the practice of the Wisconsin Militia two years ago, and it resulted in the death of the gunner.

It is hard to decide definitely the cause of these explosions, several of which have occurred in the firing of 3-inch field guns, and with varying results. One thing however is clearly defined whether such explosions are accompanied by loss of life or not—expensive and valuable property, a character of which we possess far too little is totally destroyed. The most recent models of these guns are built of nickel steel, and to test their ability to stand the shock of premature shell explosion they have been subjected to a practical test, by the exploding of a shell in the gun chamber and with the gratifying result that the gun built of nickel steel is capable of standing the great strain without rupture. Our field artillery is inadequate, and our nickel steel guns too few.

Three-inch gun burst by premature explosion of a shell



An explosion that resulted fatally

Dogs for the Dutch Army

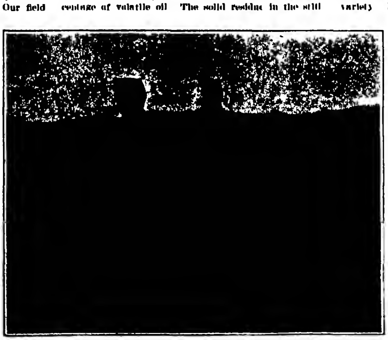
By W. J. L. Kiehl

DURING the military maneuvers last summer it often happened that the *mitrailleur*—a quick firing machine gun for the infantry—arrived too late at the point of destination.

This deficiency was caused by the difficulty of transport, for the gun with support weighs 175 pounds, the gun being 42 pounds and the support 133 pounds. This is a heavy load for men to carry, combined or separate. To remedy the difficulty the Dutch army authorities are now making experiments with the invention of a Belgian officer, i. e., a very light cart drawn by two strong dogs. This device has already been adopted by the Belgian army for the transport of infantry *mitrailleurs* and has been found eminently satisfactory—even more so than the transport by horses of this same kind of guns for the artillery.

The very light cart, whose construction can be plainly seen in the photograph, weighs 220 pounds. Dogs and cart can very easily jump across any obstacle in the way and the gun can be placed in position by two men. The same kind of carts and dogs are used to transport the ammunition.

The way the dogs are harnessed is plainly shown in the picture. So proud are the dogs of their task and so faithful that none other than the men of the company to which they belong will dare to touch the gun.



Dog-drawn artillery of the Dutch army.

The Coking of Coal at Low Temperatures

IN a series of experiments carried out several years ago by Parr and Francis at the University of Illinois it was found that by coking coal at a comparatively low temperature, say 700 deg. Fahr. or less, the heavy hydrocarbons—those chiefly responsible for the formation of smoke—could be driven off yielding a gas of high illuminating power and a tar with a high percentage of volatile oil. The solid residue in the still however was too friable to be adapted for ordinary use as a fuel. At the same time it was observed that an important rôle was played by small amounts of oxygen in the gases surrounding the heated mass of coal.

More recently this line of investigation has been followed out further by Prof. S. W. Parr in collaboration with H. L. Olin. They find that under suitable conditions it appears to be feasible to prepare from Illinois coals, by coking at low temperatures, a coke satisfying all ordinary requirements as regards texture and firmness. We say "under suitable conditions"—for it appears to be essential to maintain an oxygen-free atmosphere around the coal during the process. This was accomplished in the experiments of Parr and Olin by heating by means of steam introduced directly into the retort. At the temperatures employed there was no chemical action between the coal and the steam.

The authors conclude from their observations that "the fusible substance of Illinois coals is the true binding material in the coking process; that it is present in such abundance as to produce a coke of too open and spongy a character as a result of the evolution of the large amount of gaseous products which result from its decomposition. In this respect it is paralleled by the behavior of sugar in the process of coking, which yields as a result of the large volume of escaping gases a very porous mass of sugar coke or carbon. However, if the raw coal is mixed with a considerable amount of material which has already gone through the coking process, or which has at least given off the larger part of its gases and then has been reduced to a fine division like breeze, the cementing material of the fresh coal is able to disseminate throughout the mass and the gases may also escape without blowing it into a spongy mass, with the result that a coke of good texture is formed. Exactly in a similar way, if molasses or other sucrose or glucose material be substituted for the fresh coal we shall have again the formation of a dense coke capable of retaining its shape under conditions of firing much better than where a plastic binder is used. In both cases a strongly coherent mass is produced which meets the requirements of handling, storage and combustion with the greatest efficiency and the least formation of smoke. A small admixture of raw coal may thus be made to serve the purpose of a binder for material otherwise wasted as coke breeze at a cost which would enable it to compete with the pitch binders now in use. This suggests a process of fractional coking or coking in two stages. The first result at the lower temperature furnishes a product which, when ground to a moderate degree of fineness and mixed with a small portion of fresh raw coal, would furnish the essential conditions for producing a coke of dense nature with a binder so distributed as to give the material a strength quite comparable with that produced by coals of the regular coking variety. Moreover an advantage would be evident in such material especially for use in household appliances in that it would be more lively in combustion and less difficult of manipulation in the matter of maintaining a fire than coke made by the usual methods."

For further information regarding this important investigation the reader must be referred to our current SUPPLEMENT.

We shall here only add a brief reference to the work of another investigator Dr. F. R. Bergius, who has shown that by working under pressure and at a moderate temperature we can accomplish in the brief space of a few hours a result closely analogous to that produced by nature in a long time. He heated cellulose at 250 degrees in water in a closed electrically heated furnace until the pressure became 100 atmospheres. Samples were taken from time to time and it was found that the cellulose had been changed to peat. The result was obtained in twenty four hours, no further change being obtained in sixty hours.

By applying the Van't Hoff-Nernst law of reaction velocity, it is found that the same change from cellulose to peat at 10 deg. Cent. requires 7,000,000 years—a geological period.

Discovery of the Infantile Paralysis Germ

By Genevieve Grandcourt

THOUGH at present we are unable to stop the ravages of infantile paralysis, the recent discovery of the germ responsible for it is a long step in that direction.

It is now nearly three quarters of a century since Heine, a German physician, made clinical observations of a character which established acute poliomyelitis (infantile paralysis) as a disease of a distinct character. Twenty-nine years ago Strümpell first broached the theory that this, in common with certain other paralytic seizures, is due to the presence of a germ.

From the time of the recognition of infantile paralysis as such, about fifty epidemics have been brought to the attention of physicians for systematic study. The one which prevailed in Sweden in 1880, and which furnished valuable data for extended research, seemed the starting point for an annual recurrence. By turns in France, Italy, Germany and the United States, human beings—principally very young children—have gone down in numbers before its blight. And in 1905, Wickman laid emphasis upon what has proved to be a most important fact, that those cases of infantile paralysis which never fully develop in certain people, play a large part in the spread of the disease.

In order to understand this, differences in the nature of resistance in individuals must be taken into account thus: A child of three years is taken sick with headache and fever. Three days later, entirely without warning, paralysis creeps up the legs, ascends to the arms and after an interval of possibly five days, interferes with the heart action and causes death.

Another child in close association with the fatal case may have practically the same symptoms, but may never develop paralysis, being an example of the abortive type which is not the less to be reckoned with when public danger from the disease is considered.

Obstacles in diagnosing the illness were for a time insurmountable, not only because paralysis came on after a preliminary illness so slight as scarcely to afford warning of the need for a doctor, but because after the patient apparently recovered, he became, sometimes within a few days, suddenly and hopelessly crippled.

The presence of infantile paralysis came to be recognized at autopsy by scars along the spinal tract not to be found in other parts of the body. Though functional changes in organs were effected, the nervous origin of the trouble was manifestly to be investigated as the furnisher of symptoms. When paralysis was coming on the limbs of one side of the body would be a drag on those of the opposite side, the weight resulting in fatigue.

Though adults suffered from the disease, the largest known proportion was about one fifth of those stricken in the course of an epidemic, the favorite victims being children in their third year. In country districts, the disease seemed to radiate from the public school. The carrying agent was believed to be always the human being, no animal suffering from a form of paralysis that could be studied as co-related to it.

Some years ago, Landsteiner of Vienna confirmed Strümpell's theory of an infectious agent by transmitting the disease to monkeys. This made it possible to study the disease objectively by a new method, and since that time scientists have been giving it great attention.

Though the infantile paralysis virus does not flourish with equal facility in all individuals, it is hard to kill. Its presence in the brain, spinal cord and tonsils of recently dead human beings and monkeys has been shown by inoculation, for example of material obtained from the nasal passages of monkeys. Moreover, experiments show that the germ does not die of prolonged heating or freezing unless excessive.

Much of the important work along these lines has been done at the Rockefeller Institute under the direction of Dr. Flexner. Experiments on animals afforded the hint that the infection may be carried from and to the mucous membrane of the nose by loud speaking, coughing, sneezing, etc.*

It is now supposed that the virus enters the body through the nasal passages and is carried by the lymphatics along the route of the olfactory nerve to the membranes that envelop the brain and spinal cord. Whether intermediate agents, such as flies and other domestic insects, play a part in the transmission, is not yet definitely established.

Flexner's work for a long time dealt with prevention and alleviation. During the summer of 1911 a large number of patients suffering from this disease were admitted to the Rockefeller Hospital, while a still greater number were treated in the clinic.

Meantime, work was going on in the bacteriological department of the Institute which was destined to have great bearing on this particular study.

A year ago, Hidyeo Noguchi, the Japanese scientist at the Rockefeller, succeeded in growing for the first time the *spirochaeta pallida* (the germ of syphilis). This germ was first discovered by Schaudinn in Germany, and was later developed in animals at the Pasteur Institute in Paris by Drs. Levaditi and Besredka.

Noguchi's success in developing it was due to very special research on which he had been engaged for some time with reference to the culture of anaerobic germs, i. e., germs that cannot be grown in the presence of air. And Dr. Flexner suggested, not long since, that he apply these brilliant new methods to the problem of growing the hitherto undiscovered germ of infantile paralysis.

This germ appeared to be one of the so-called "ultra-microscopic" variety, that is to say, a virus so minute as to be invisible through the magnifying-glass and to pass through the pores of porcelain (Berkfeld) filters.

Acting on Dr. Flexner's suggestion, and enforcing the very strictest conditions of air exclusion, Dr. Noguchi has grown the germ of this frightful malady from the brains and spinal cords of children who have died of it, grown them in human serum kept in long, deep tubes. On the top of the serum is a layer of paraffine to keep out the air, and the germs grow only in the very bottom of the tubes in the position most distant from the air.

In the light of this scientific feat, these germs appear to be not truly ultra microscopic, in spite of the fact that they are small enough to pass through the Berkfeld filters. They can be seen through the microscope as exceedingly tiny granules or globular bodies, in a variety of arrangements, growing singly, doubly, in short chains or in masses. They can be stained a reddish violet with the well known Giemsa stain by means of which the syphilis germ was first identified.

As a guarantee of the genuineness of this discovery, the crucial test proposed by Koch of Germany has already been successfully applied. This test has been applied in order to establish whether the newly discovered germ is really the cause of the disease under investigation. Germs which have been cultivated through several generations have given the experimental disease of infantile paralysis to monkeys. Then they have been recovered again from the bodies of these animals, precisely as in cases which have been so constantly under observation in the past.

It is needless to say that this discovery is of the very greatest importance in the diagnosing and treatment of cases, and that it justifies the expectation that the day is not far distant when science shall have this devastating disease under relatively perfect control.

* Rock. Inst. Reprints, vol. xvi, p. 1

Lightning Calculations

Extracting Roots of Numbers by Inspection

By Alfred J. Lotka

AT a recent meeting of the Société Française de Philosophie, M. Quinton astonished the members present by extracting cube roots and fifth roots of given numbers at sight. The matter has received considerable discussion in the daily newspapers, but for some reason the method employed has not gained very general publicity, nor has the *rationale* of the process been exposed. I shall first of all describe the method as reported in *Le Matin* and *La Nature*, and shall then show how the rules given follow from simple mathematical considerations.

It should be remarked at the outset that the method, as described in the sources quoted, applies only to perfect cubes, and, generally, to odd powers of whole numbers. A few examples will best serve to explain it.

As regards fifth roots, M. Quinton observes that the last digit of the fifth power of a whole number is always the same as the last digit of the number itself. Thus, $1^5 = 1$, $2^5 = 32$, $3^5 = 243$, $4^5 = 1{,}024$, $5^5 = 3{,}125$, $6^5 = 7{,}776$, $7^5 = 16{,}807$, $8^5 = 32{,}768$, $9^5 = 59{,}049$. Hence, if given the fifth power of any of the numbers 1 to 9, and asked to extract the fifth root, we can do so instantly by inspection of the last digit. If the number given exceeds 9^5 the process is a little more complicated. It becomes necessary to memorize the fifth power of the first nine digits, as given above. An example will best illustrate the method. It is required to find the fifth root of 229,345,007, this number being the fifth power of a whole number. The last digit of the root sought will, as before, be 7. To find the other digit, inspect the digits of 229,345,007 which precede the tens of thousands and do not exceed ten billions (ten thousand millions). In the present case they are 2,293. Now 2,293 falls between 4^5 and 5^5, as will be seen by referring to our list of fifth powers above. Then the last digit but one of the number sought is 4, and the entire number is 47, as the reader may convince himself by trial.

For cube roots the method is slightly different. M. Quinton observes that the cubes of 1, 4, 5, 6, 9 end in 1, 4, 5, 6, 9, while the cubes of 2, 3, 7, 8 end in 8, 7, 3, 2, i. e., in numbers found by subtracting 2, 3, 7, 8 from 10. The cube roots of numbers less than 1,000 are therefore obtained by inspection of the last figure as follows: $\sqrt[3]{8} = 10 - 8 = 2$, $\sqrt[3]{27} = 10 - 7 = 3$; $\sqrt[3]{64} = 4$; . . . $\sqrt[3]{729} = 9$. For cube roots of the higher numbers we must memorize the cubes of the numbers between 1 and 9. Thus $\sqrt[3]{5{,}832} = 18$, for $(10 - 2) = 8$ and 5 lies between 1 and 8 and therefore has a root lying between 1 and 2. The digit in the tens is therefore 1, and the number sought is 18, as stated.

M. Quinton has similar rules for extracting the 7th, 9th, 11th roots, etc.

Now let us see how we can account for these remarkable facts.

Let us consider the case of the fifth root. We want to show that the last digit of x^5 is x. This is the same thing as saying that the last digit of $(x^5 - x)$ is zero, or that $(x^5 - x)$ is divisible by 10. Now $(x^5 - x) = x(x^2 + 1)\ (x + 1)\ (x - 1)$.

It is immediately obvious that if x itself is divisible by 10, then $(x^5 - x)$, since it contains the factor x, will also be divisible by 10. Furthermore, if the last digit of x is 1, then $(x - 1)$ is divisible by 10. But $(x - 1)$ is a factor of $(x^5 - x)$, which is therefore also divisible by 10. Similarly if the last digit of x is 9, then $(x + 1)$ ends in zero, and so does therefore $(x^5 - x)$.

Now if x ends in 2, then x^2 ends in 4, and $(x^2 + 1)$ in 5. Hence $(x^5 - x)$ contains the factors 2 and 5, i. e., its last digit is again 0. Again, if x ends in 3, x^2 ends in 9, and $(x^2 + 1)$ in 0. Thus $(x^5 - x)$ ends in 0. If x ends in 4, $(x + 1)$ ends in 5 and $(x^5 - x)$ contains the factors 5 and 4, that is to say, it ends in 0. If x ends in 5, $(x + 1)$ is an even number, and hence $(x^5 - x)$ contains the factor 10. If x ends in 6, $(x - 1)$ ends in 5. If x ends in 7, $(x^2 + 1)$ ends in 0. If x ends in 8, $(x^2 + 1)$ ends in 5 and $(x^5 - x)$ contains the factors 2 and 5. Our proposition is therefore proved.

The *rationale* of the rule for numbers greater than 9 is so obvious as to require no explanation. The rules for the third, seventh and other powers can be explained by a similar process, which I may leave to the reader to work out. I will only add that $(x^5 - x)$ is divisible not only by 10, but also by 3, as the reader may show either by inspection of the fifth powers cited above or by a process of reasoning similar to that developed here.

The Current Supplement

MR. FRAASA'S article on the construction of a self starting induction motor is concluded in this week's issue of the SUPPLEMENT.—Mr. R. H. Rogers tells us "why our freight traffic costs us five times as much as national, State and local taxes combined."—The musicians among our readers will be interested in the illustrated description of a typewriter which prints music characters.—V. Jefferson Watts contributes an article on Knowledge and Morals, which is referred to more at length on our editorial page.—E. V. Huntington gives a simple formula for computing gyroscopic forces in aeroplanes.—A highly efficient photo-mechanical process for preparing illustrations, which has found extensive applications and promises still further development in the future is described.—Prof. J. J. Thomson continues his discourses on "The Structure of the Atom."—A. Whitehead discusses some indirect causes of imperfect interchangeability of machine parts.—Prof. S. W. Parr of the University of Illinois, collaborating with H. L. Olin, has conducted important researches on the coking of coal at low temperatures. A detailed extract of their report appears in this issue of the SUPPLEMENT.—E. F. Bashford discusses the relation of certain cases of cancer to the presence of parasitic worms in the body of the animal afflicted.

A New Method for Cooling Mines

A GERMAN engineer, M. Dietz, proposes a method for cooling the air in mines, which will overcome the existing difficulties. The temperature in mines, which increases with the depth of working, makes it necessary to fix a maximum number of hours per day for the miners, and in the German mines where the temperature often exceeds 28 deg. Cent. the men do not work more than 6 hours per turn. Such conditions cause a greater expense for labor and a lessening of the yield, and the present method is intended to keep the temperature below 28 degrees at the working points so as to allow of a continuous working as in other industries. After showing the reasons why previous attempts in this direction were not successful, he exposes his method, which is to compress air at the surface of the ground and then put it through a drying process. The compressed air then goes into an expansion apparatus or air turbine, where it expands and furnishes work to this machine. The air also becomes cold by the effect of the expansion on the well-known principle, and it is then taken by means of a protected piping into the mine and delivered at the proper point so as to secure a good ventilation and a cooling of the air within the mine. In this way he claims that the mine can be cooled more effectively than heretofore.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Inventors and Their Needs

To the Editor of the SCIENTIFIC AMERICAN

You render invaluable service toward advancement by publishing the letter of Mr Kennedy in your issue of March 29th The subject surely demands serious action

The inventor, as a rule, is not "money-wise", his vocation is to serve humanity, and he should not be deprived of reasonable compensation nor permitted to fall into the trap of the mercenary Many lose through indiscreet confidence in the personal representative of capital. I happen to know through experience There may be a law to protect ideas, but the inventor has no money to go to law when called upon to defend himself

I am now working upon ideas pertaining to a rotary gasoline engine, also a device for launching lifeboats in heavy seas and a life-saving device for use in the tall buildings when fire escapes, ladders, and all other means fail. It is remarkable that the last is not already in general use, but it is not, and as usual the device is of quite simple construction and of genuine merit.

You should reprint Mr Kennedy's letter

Cincinnati, O — HOWARD SMITH

The Falling Elevator

To the Editor of the SCIENTIFIC AMERICAN

My attention has been called to an error in the issue of SCIENTIFIC AMERICAN of March 8th On page 233 you say "It is interesting to note that as the falling distance is four times the stopping interval, Mr Ellithorpe will, during the latter interval, have his weight increased fourfold. Such is not the case. His weight will be increased fivefold

Suppose the falling interval is 400 feet and the stopping interval 100 feet. Suppose a man weighs 100 pounds Work done by gravity on man in total descent $=100\ (400+100)=50{,}000$ foot pounds. This must be absorbed in the latter interval of 100 feet Hence pressure of man on elevator $=50{,}000$ foot pounds divided by 100 feet $=500$ pounds. If the man's weight is 150 pounds he will "weigh," during the stopping period, 750 pounds

This is supposing the stopping acceleration to be uniform, which of course it can not be, for if his pressure were to change from 0 on the elevator to 750 pounds suddenly, he would collapse Hence, as you point out, the negative acceleration must increase gradually This will make the pressure of a 150-pound man much more than 750 pounds during the latter portion of the stopping period — J. S. COON

Atlanta, Ga.

The Mississippi Problem

To the Editor of the SCIENTIFIC AMERICAN

I saw some articles in your paper discussing methods of improving the Mississippi River There is one fact about the Mississippi to which you do not seem to attach any importance, and that is, it is a silt-bearing stream, which should not be left out in any plan for the control of the river It is, as you say, not practical to regulate the quantity of water in the river by retaining in reservoirs, in the upper sections of the river, enough water to prevent overflows in the lower sections. Every inch in the rise of the river increases its carrying capacity, not so much because of the volume added to the mass of the water, but because of the increased speed of the current. I saw observations made by an engineer at New Orleans which showed that at high water, a rise of twelve inches doubles the quantity of water passing at New Orleans. As a difference of no more than one foot at New Orleans would not have been sufficient to prevent the river from overflowing in 1912, reservoirs having the capacity of preventing the river from overflowing in that year should have been extensive enough to retain considerably more than one half the water that drained into the river, and this would require the condemning of a territory larger than several States. It is clear enough that the capacity of the river to carry water must be increased, and that levees do increase this capacity, but it is not clear that levees are the only means which can increase the water-carrying power of the river The effect of levees is to increase the thickness or depth of the water; the measure of the increase is from the level of the land on the banks of the river to the top of the levee; if there were no levee, the same thickness or depth of water would be secured by removing the required number of feet of earth from the bottom of the river Nor is it certain that it is absolutely necessary that so much water should be wasted every year.

If a State must use its own means only to protect itself from the river, it is clear that it must build levees, there is nothing else it can do; but the boundaries of the Union include the entire length of the river and its tributaries. The only manner in which money can be profitably expended by one State in controlling the river, is by building levees, but with the general Government, the case is very different

The general Government can utilize the natural law which governs the amount of sediment water holds in suspension depending upon the motion of the water and on the velocity of that motion If a given amount of earth be placed in the bottom of a vessel containing clear water, and the water be quite still, it will remain clear, none of the earth will rise into the water, all will remain in the bottom of the vessel If then the water be stirred and made to acquire a motion, it will take from the bottom and hold in suspension an amount of earth proportioned to the velocity of the motion, the amount of earth in the bottom of the vessel will be decreased and the depth of water will be increased If water resting on earth be perfectly still, it will become clear, but if the water acquire motion, however slow, it will contain sediment. Since the amount of sediment water will hold in suspension is in proportion to the velocity of the motion of the water, in order to deepen a silt bearing stream, it would be necessary either to increase the velocity of the current without increasing the amount of silt draining into the stream, or to diminish the amount of silt draining into the stream without diminishing the velocity of the current

Surface drainage of rain water carries with it quantities of the earth over which it passes Such water having all the sediment it can carry possesses no scouring power, it cannot deepen a stream, it may even cause a stream to shoal if the current be checked as, for instance, by the work at the Southwest pass

Much of the sediment in the Mississippi comes from the Missouri If the land which furnishes the mud to the Missouri were tile drained this water would be clear While the Missouri would be deepening it would continue to discharge much sediment in the Mississippi and this river would not deepen at once, but when the Missouri would have deepened sufficiently so that its current would have become slower, its water would become comparatively clear, and this water coming into the Mississippi as clear water instead of as muddy water, would diminish the total quantity of sediment in the Mississippi, and this river would deepen in consequence I mention the Missouri because of the quantity of mud it discharges, but the Ohio should not be overlooked, since this is the river which furnishes the water which floods the lower Mississippi

The quantity of water coming from the Missouri compared to the territory which it drains would seem to indicate that the rainfall in that territory is not sufficient If this territory were tile drained by tiles located below the hard pan, all that portion of land between the tiles and the surface would become more or less porous and would retain moisture to increase the yield of the land

Deepening the river by means of diminishing the quantity of sediment in its water would deepen the channel at the mouth for ocean-going vessels

There is a manner in which the deepening of the river would bring in returns enough to repay many times over any sums that might be expended There are quantities of land, extending in some places more than a hundred miles in width from the Mississippi which, from having been covered by the floods of the river for generations, have become elevated by the silt deposited on them These lands cannot drain naturally into the river at high water As more silt was deposited near the source of supply than at a greater distance, the lowlands along the river have a gradual slope to the Gulf, so that by building levees which prevent the river from directly overflowing land behind the levees, this permits the draining of these lands into the Mississippi at points below Above Red River, land on the Mississippi can not drain directly into the Gulf, but must return into the river If the river were deepened so that at the highest point it could reach it would still be as little as ten feet below the highest point it reaches now it would be difficult to estimate the gain that would result

Thibodaux, La. — JULES LAFOREST

A Plea for the Patentee

To the Editor of the SCIENTIFIC AMERICAN

Were all improvement to cease with the present day, all inventions to end, then an unjust, iniquitous law that would deprive the inventor of his well-earned "monopoly" might be passed with impunity, for it would only rob one class of people, the inventors, the men of progress, those men who have made the world better, living cheaper, conveniences greater

But will men of brains, men of genius, men of inventive talent, spend months and years of study and labor constructing, improving, creating some new machine for the use of mankind, some valuable process by which commodities are cheapened for the use of the many, when the patent laws will not guarantee them at least the pecuniary patronage as the result of years of disheartening labor? I speak from experience as well as from observation There are hundreds of inventions to-day that have never been patented by their inventors, some to my own knowledge of great value, inventions that rightfully remain undisclosed to the public And why? Why? Because the public says "We will take your invention and give you no just recompense for your years of study and labor" And the inventor replies to the public "Keep your money, and I will keep my invention" The pressure of ignorant opinion might cause the enactment of less effective patent laws, but neither the public nor the law can compel the inventor to disclose his invention And who is the greater loser? The inventor who must needs get his livelihood by means other than invention, or the great public, which never benefits by some improvement, some commodity, which never even knows what benefit it has deprived itself of?

I say the patent laws are not strong enough We should have a patent law that would make it *the duty of the Government* to prevent infringements of patents without putting that burden upon the inventor And we should have negotiated between the nations *a universal patent law*, whereby a patent might be taken out (at an additional not prohibitive cost) to cover all countries

Washington, D C — WILLIAM EDWIN EMORY

Certain Unrecognized "Patent Rights"

To the Editor of the SCIENTIFIC AMERICAN

Many inventions are produced almost simultaneously by parties having no knowledge of the other's doing, in which case the second inventor fares rather poorly under the present patent system In an interference suit the Patent Office awards priority of invention to one party, and will grant patents on their specific details to the other contestants who will be subject to the broad patent This can hardly be otherwise But in many cases has not the second inventor vested rights?

Most inventions of merit are worked out practically, often at great expense, and frequently marketed before a patent application is filed When two or more inventors independently demonstrate equivalent inventions about the same time they may both be said to advance the art substantially equally In such a case if the losing party in an interference shows that he would suffer by prohibition of the use or sale of his invention should be not be allowed a license, secured by compulsion if necessary, under the master patent?

Probably in the future, inventions most beneficial to the community will be the result of careful scientific development Instead of being so much the work and thought of one person, an industrial advancement will evolve from experiment and elimination conducted by men in collaboration The industrial and experimental laboratories of corporations, colleges and scientists will no doubt contribute most toward industrial progress

If several well-equipped organizations are scientifically working to improve similar products, supply the same public demand, or open a new field, they will in many instances obtain substantially equivalent results In such case there will need to be provision that a technically second inventor be not deprived of his invention to his financial loss

One of the risks in developing an invention is that someone else may be first and by a controlling patent absolutely prevent its use The master patent may even issue subsequently to the patent dominated, provided it was filed before or within two years of such patent

The parties adversely affected have no redress, but could receive equitable treatment by means of a compulsory license granted on reasonable terms Would this not remove a certain speculative feature from the field of industrial development and make it a sounder business undertaking?

Another feature is that an inventor of a revolutionary improvement may find his progress blocked unless he can secure license to use other inventions as was Bessemer by Mushet. (Note SCIENTIFIC AMERICAN SUPPLEMENT, December 28th, 1912) A logical or almost obvious improvement may be patented to someone else who endeavors to exact undue tribute for the patent law makes no distinction between originative and intensive invention or those of much or little potential value to the country's industries

Reverting to the evolution of inventions by the collaborative work of employees of corporate bodies, can we not say that an incorporated company invents? It cannot only buy and sell goods, but traffic in intangible things, as good will, franchises, licenses, and so forth Probably many patentable improvements are not the invention of one person or the joint invention of several, but the industrial evolution produced by experimentation of scientists, engineers and mechanics in the employ of an incorporated body The patent law does not recognize such corporate inventing, and of course if it did should carefully protect independent inventors.

Ottawa, Canada. — F D WITHROW.

Brucker's Balloon Trip Across the Ocean

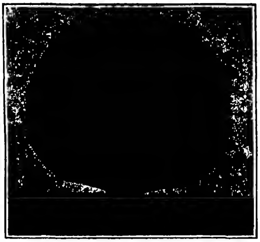
By Our Berlin Correspondent

THE daily press recently published a notice that the scheme for the transatlantic balloon expedition originated by Joseph Brucker, at the beginning of 1910, had been abandoned. Dissensions among the members of the expedition (Mr. Brucker, Dr. von Gans, Capt. Hortens and Dr. Alt) were said to be responsible for the fact that the original plan of crossing the ocean with a dirigible though with the aid of trade winds, had to be given up. However, some of the members were so greatly attached to the idea that Joseph Brucker made up his mind during the present spring to try the passage single-handed by means of a spherical balloon from the Canary Islands.

The balloon destined for this transatlantic trip was constructed and equipped in the relatively short time of six weeks and on February 28th performed a trial flight attended by representatives of the Bavarian military authorities. The balloon, 7,250 cubic meters in capacity, ascended on the stroke of 12:30, and after reaching in a short time a height of 2,350 meters, sailed between two thick cloud strata toward the Inn Valley, landing at 3 o'clock in the Chiemsee district.

Special importance is attached to the sprinkling arrangement designed on plans by Mr. Brucker and Dr. Alt of the Munich Meteorological Institute. This arrangement consists of rubber hose and is intended, in the case of intense sun radiation, to sprinkle and cool the balloon with a spray of water, thus preventing any undue expansion of the gas.

After this successful trial trip, the balloon "Suchard II" was transported to Teneriffe, from which place, according to Brucker's calculations, the cross-sea trip will last six to eight days at the utmost. The basket is seaworthy and has been equipped in accordance with such a long trip.



The balloon in which Brucker hopes to cross the Atlantic.

The seaworthy basket of Brucker's balloon.

Protection of Ocean Liners by Subdivision

THE two accompanying illustrations, showing the inner skin which has been built into two notable ocean liners, one the "Olympic," already in service, the other the "Imperator," which is about to enter the transatlantic service, prove how quickly the White Star Line and the Hamburg American Line have built into their ships the great lesson which was taught by the sinking of the "Titanic." Within a few days of the anniversary of the loss of that ship, her sister, the "Olympic," reached New York on her first voyage after six months' reconstruction at the Belfast yards. At the time of the loss of the "Titanic" the SCIENTIFIC AMERICAN pointed out that the most important lesson of the disaster was not so much the shortage of lifeboats, as the fact that the "Titanic" herself was so little qualified to serve as her own lifeboat in case of serious injury and remain afloat until her passengers could be transferred to some rescuing ship summoned by wireless. We drew attention to the fact that the "Great Eastern," launched over half a century ago, embodied in her under water construction certain principles of sub-division which rendered her so safe a ship that she could in all probability have passed through the ordeal which sank the ship of fifty years later date. The "Great Eastern" was built with a complete inner skin, with longitudinal bulkheads throughout the engine and boiler room spaces, and with bulkheads, both transverse and longitudinal, which were carried up through the full height of the plated structure of the ship to a level about thirty feet above the water line.

It was shown that, while warship constructors had retained and developed the features which made the "Great Eastern" a ship so difficult to sink, in the merchant marine there has been a gradual elimination of these elements, until nothing was left but the transverse bulkheads and the double bottom. We suggested that future ocean-going steamships could be rendered reasonably secure against sinking by building them with an inner skin and carrying the bulkheads to a reasonable height above the water line.

As the result of the Government investigations in this country and in England, and of the meetings of the various committees appointed to investigate the subject of sub-division, the principles to which we drew attention at that time have been broadly accepted. The White Star Company withdrew the "Olympic" from service and sent her to the Belfast yards, where alterations have been made which have cost the company about $1,500,000. These changes, which have involved the working into the structure of the ship of an additional one thousand tons of steel, are as follows:

To the original fifteen transverse bulkheads, an additional bulkhead has been added, dividing the ship into seventeen separate watertight compartments. The original height of the top of the bulkheads amidship was about ten feet above the water line. In the reconstructed ship about one half of the bulkheads have been carried up to the top plated deck at a level of about forty feet above the water line. Bulkhead No. 1 has been carried up to the forecastle deck at an elevation of about forty five feet above the water line, and No. 2 bulkhead has been raised to C deck, one deck higher than formerly. Below the water, steel watertight flats have been built, covering the space between the stemhead and bulkhead No. 2, and forming two entirely separate watertight compartments. No. 3 bulkhead extends to E deck, No. 4 to B deck, No. 5 to E deck. No. 6 bulkhead extends to B deck, as does also bulkhead No. 10 and the new bulkhead known as No. 12A. Bulkhead 13 also is carried to B deck. No. 14 reaches E deck and No. 15 extends to D deck. The two after compartments are covered below water by watertight floats or deck near the water line. These changes more than conform to the suggestions made by the Senate committee that investigated the loss of the "Titanic."

A complete inner skin has also been built throughout the length of the boiler- and engine-room spaces, by carrying the floor of the ship up to the full height of the main frames, to which it is everywhere strongly riveted. The outer and inner skins are connected by a series of intercostal and longitudinal frames and each double side wall as thus formed between two transverse bulkheads, is divided into four separate watertight compartments by a central vertical and a central longitudinal diaphragm.

To assist in ridding the ship of water in case of injury, an eight-inch pipe which extends the whole length of the ship has been added to the drainage facilities, and it has connections which enable each tank top to be drained independently. This pipe leads to its own independent pumping plant.

Watertight electrically operated doors, all of which may be closed from the bridge, are fitted in all the extensions of the bulkheads. It should be mentioned also that in the two bulkheads which intercept the working alleyway (which latter proved a serious factor in the loss of the "Titanic") watertight doors are provided.

All of the bulkheads, old and new, and the bulkhead doors, have been greatly strengthened by riveting upon them additional heavy channels and angle irons, their strength being estimated for the maximum possible submergence of the ship.

At the time of the loss of the "Titanic," work on the construction of the "Imperator," of the Hamburg American Line, had not progressed so far but it was possible to introduce additional subdivisions designed to protect the ship against an iceberg collision such as befell the "Titanic." The "Imperator," as at that time constructed, was provided with an inner skin, in the shape of the inner walls of the coal bunkers, which extend throughout the full length of the boiler spaces. This inner skin is situated from fifteen to eighteen feet inboard from the outer skin of the ship and, therefore, in the event of the rupture of the outer skin, say by a colliding ship, the inner wall is so far removed as to be beyond any likelihood of injury. This is the method of arranging the coal bunkers which is practised in all the navies of the world, and it gives great

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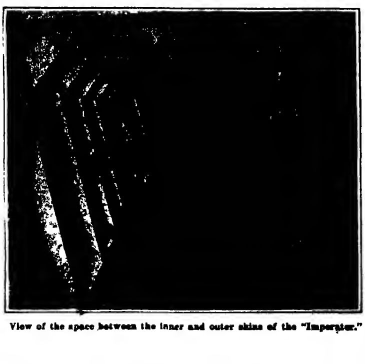
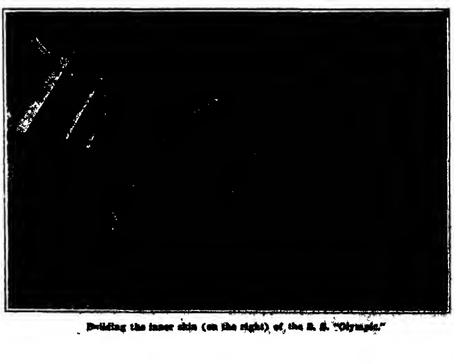


View of the space between the inner and outer skins of the "Imperator."



Building the inner skin (on the right) of the S. S. "Olympic."

Babylonian Excavations by the Germans

How Nebuchadnezzar and His People Lived

By Edgar J. Banks

THE excavations conducted by the Germans in the Mesopotamian Valley began in 1899, and are still continued. The ruins of several Babylonian cities, Abu Habba, Fara, Babylon and of the Assyrian capital Assur, have been uncovered in a most systematic manner. The results have been meager in some of the ruins; in others, they have been of the greatest archeological importance. The general oversight of the entire field has been in the hands of Dr. Robert Koldewey, an architect, who has personally superintended the excavations at Babylon, and who has had a large and varied career in Oriental excavation work. He has been assisted by several Assyriologists and architects; of these, Dr. Maresh, now in charge of the work at Assur, deserves great credit. The funds for the support of the excavation have been provided by the *Deutsche Orientgesellschaft*, to which the German Emperor has been a liberal contributor. This German activity in Mesopotamia far surpasses that of any other nation, which activity may be due to the fact that the German government would increase its influence in that part of the world, perhaps with the hope that when the German railroad across the northern desert to Bagdad shall have been completed, this land of mineral wealth and of ancient ruins may be practically German territory.

The First Excavations and the Result

Abu Habba, a small ruin in central Babylonia, and Fara, a few miles further south, were the first to attract the German excavators; the results at these two ancient sites were comparatively insignificant. At Abu Habba trenches revealed scarcely more than the walls of the houses from a middle period of Babylonian history, and the work was soon abandoned. At Fara, a low mound half a mile in length and about half as wide, work was continued for about nine months with a force of two hundred men. Beginning at one end of the ruins, trenches about 10 feet wide and 5 feet deep and a few yards apart were dug entirely across the mound, and whenever the walls of a house appeared they were followed until the nature of the structure was revealed. The results were few. An abundance of pottery, some marble vases, vertical drains of tiles and wells only were discovered. Finally, when the system of trenches had been carried the entire length of the mound, a large palace of an exceedingly early age appeared. In the chambers were several large clay tablets covered with primitive cuneiform characters. It happened that in a fight during the work an Arab was killed, whereupon the excavations were stopped by the Turkish government. The inscriptions revealed the ancient name of the city as Shuruppak, the scene of the Babylonian story of the flood which appears in the Gilgamish epic.

A valuable discovery at Fara was a large arch sewer beneath the city. Though we have long been taught that the arch was of Roman origin, the arch of this sewer was perfect and symmetrical, and from an age not far from 4500 B. C., when the pre-Semitic Sumerians occupied the land. The bricks used in its construction were plano-convex, resembling in shape and size a small loaf of bread; they were burned to a dark red. The plano-convex bricks appear to have been the first burned bricks ever employed.

Attacking the Site of Babylon.

Could the excavations have continued a few weeks longer, more remarkable discoveries might have resulted. However, the Germans then turned their attention to the ruins of Babylon on the left bank of the Euphrates, 70 miles south of Bagdad. Unlike most Babylonian cities, the site of Babylon had never been quite forgotten. Travelers of every age have described it. Nearly a century ago large square bricks bearing cuneiform inscriptions with the name of Nebuchadnezzar were taken to the British Museum, and the ruins have long been a profitable source of revenue to the Arabs who have searched among them for bricks. Hillah, a city of 10,000 people, is constructed of them. The court yards of the houses and a large city square are paved with them; they have been employed in the construction of an irrigating dam across the Euphrates, and still the supply seems inexhaustible.

The ruins of Babylon consist of three large and several small mounds. Surrounding them is a ridge of dirt, reaching in places to a considerable height, and representing the city walls. Herodotus says the walls were 335 feet high and 85 feet wide. Other writers claim that they were from 42 to 56 miles in circuit, that they were surrounded with 250 towers, and pierced with 100 gateways with gates of bronze. Though the Germans have attempted to trace the walls throughout their extent, they have but partly succeeded; yet it seems that the ancient writers were fairly accurate in their descriptions.

Of the three larger mounds, Babil, the one to the north, still retains its ancient name. Square in shape, it rises to a height of over 100 feet. Specially here have the Arabs long been digging for bricks. The Germans have paid little attention to this mound except to examine the walls which the Arabs have uncovered. Dr. Koldewey believes that an ancient structure which gave rise to the Biblical story of the Tower of Babel stood there. At the base the Arab diggers have revealed the huge arches of passageways leading through the mound, and they have led some scholars to believe that they supported the famous hanging gardens of Babylon. It is supposed that the overhanging foliage of the several terraces had the appearance of being suspended in the air.

The central of the three large mounds is the Kasr, or the fortress, so named by the Arabs, because of the massive walls which have always projected from the surface. Here the Germans have made their most remarkable discoveries. It is the custom of the Germans to employ a force of two hundred men the year around. The men are divided into gangs of twelve each. At the head of the gang is the pickman who loosens the dirt; his pay is twenty cents a day. With him are three men with triangular hoes, who scrape the dirt into baskets; their pay is sixteen cents a day. The remaining eight men of the gang are basket men who carry the dirt from the trenches to the dump or the car; their pay is twelve cents a day. Small children are employed at the rate of four cents a day. It is only at Babylon that a narrow iron track with small push cars to carry the dirt to the edge of the mound, has ever been employed in Babylonia.

Babylon a Comparatively Modern City

The antiquities discovered in the Kasr have not been so ancient as the Germans had hoped. Babylon is a modern city when compared with other Babylonian cities to the south. Sinacherib, King of Assyria from 705 to 681, boasts that he completely destroyed it, scraping even its foundations into the river. It is a fact that little or nothing previous to Sinacherib's time has been found. The Babylon whose ruins still exist is the city of Nebuchadnezzar; the palaces and temples the Germans have excavated were constructed by him or by later kings.

An object of interest from the Kasr was found by Arabs long before the Germans began their excavations. It is a large granite lion standing over the figure of a prostrate man. The monument was never completed, and the Arabs have mutilated it by digging deep holes into its sides in their search for hidden wealth. It bears no inscription to tell its age or history. Dr. Koldewey has erected it upon a platform of bricks, where it now stands as if to guard the ruins. The first valuable object discovered by the Germans was a black monolith, brought in ancient times as a trophy of war from the Hittite city of Karkemish. It adorns Babylon just as now Egyptian obelisks adorn New York and various European cities. The front flat side of the stone is sculptured with a Hittite warrior holding his weapons in the air; the rounded back is covered with the undeciphered characters of the Hittite language.

The Palace of Nebuchadnezzar

Nebuchadnezzar's palace in the Kasr may be regarded as the greatest of Dr. Koldewey's discoveries. Little but the foundations of the palace remain, and they are of square burned bricks, each of which bears on its lower face the name and title of the great king. The several hundred chambers of the palace are small; some of them are scarcely larger than a modern bed. As they were cleared out they were found to contain little of value. One chamber, much larger than the rest, had on one of its sides a low platform of bricks. This is supposed to have been the throne room, and upon the platform the throne of the king may have stood. So thorough was Dr. Koldewey in his excavations that he removed the bricks of the walls and the paving of the throne room; now only the place where they were is visible.

There was a sacred street in Babylon leading from the palace to the temple, along which the images of the gods were carried in processions, according to a religious rite. The gateway known as the Ishtar gate, leading to the street, is most imposing, and gives us a good picture of how Babylon must have looked. Fortunately it has escaped destruction at the hands of the Arab brick diggers. Whatever its original height may have been, it still stands 40 feet above the street. Its six square towers of burned bricks, measuring twelve feet each way, contain on all their sides, one above another, beautiful reliefs of bulls and lions and dragons and animals of fantastic shapes. The reliefs are of brick glazed blue and yellow and white, and the coloring is as fresh as ever it was. Each brick of the relief was shaped and glazed separately and so accurately that when it was placed in the wall it formed a part of the perfect picture. The art could scarcely be surpassed.

The most stupendous work done by the Germans has been in Amran, the southern of the three large mounds. There, forty feet beneath the surface, below the accumulations of the Arabs and Hebrews and Parthians and Persians who have lived and built upon the site, was discovered Esagil, the famous temple of Babylon. Imagine a hole an acre or more in extent and forty feet deep, excavated entirely by hand, and you will understand the untiring patience of the Germans. Little but the foundation of the temple was found. Yet that is enough to reveal its plan, its extent, and the similarity of the Babylonian temple, with its outer and inner court, its holy of holies, its secret chambers and passageways, to the Hebrew temple.

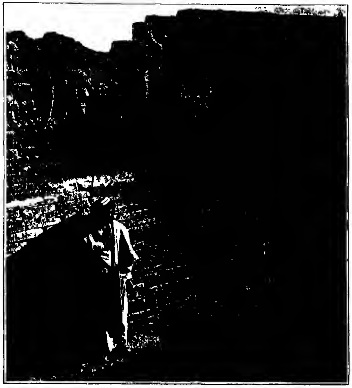
Few clay tablets have been found by the Germans at Babylon. Their smaller finds consist of Parthian coins, pottery, weights, stone implements, images, beads, jewelry and similar objects. However, in Jumjuma, one of the smaller mounds to the south, the Arabs found a large collection of clay tablets, many of which came from the Hebrew concern of the Egibi family. Egibi is the Babylonian pronunciation of the name Jacob. The tablets teach that for many generations the most influential brokerage concern of Babylon was in the hands of the Hebrew family of Jacob. Equally interesting was a clay barrel-shaped cylinder describing the capture of the city by Cyrus, King of Persia. The excavation of Babylon is not yet completed. Much of it still lies beneath forty or fifty feet of later ruins, and future results may be of greater value than those of the past.

The Excavations at Assur

The excavations at Assur, the Assyrian ruin now called Shergat, which lies on the right shore of the Tigris about half way between Nineveh and Bagdad, have been of the greatest importance. Work began there in 1904. It is expected that it will be completed in about two years. Assur was the first Assyrian capital city, giving its name to the Assyrian nation; there the oldest Assyrian monuments have been discovered. Assur continued as a sacred city until the fall of Nineveh in 606 B. C.

Dr. Andrae and his successor Dr. Maresh traced the ancient double walls of the city and the moat, and cleared the ancient gateways. In places the parapet along the outer edge of the summit of the walls was preserved, and even the loop-holes through which the archers might shoot the enemy at its base are still perfect. Within the city were discovered the earliest Assyrian palaces and temples, the home of the mayor with an intricate system of water works and drainage, a business street lined with shops and paved with blocks of marble, the thickly crowded residential section of the poorer people, the great vaulted tombs of the nobles with massive doors of stone which still swing on their stone pivots, weapons and innumerable ornaments of gold and stone. At the southern part of the city, in an open space by the walls, there appeared a veritable forest of stone monuments, monoliths from four to eight feet high, each engraved near its top with an Assyrian inscription containing the name of the king or noble to whom it was dedicated. One of them bore the name of Shammuramat, or the once supposed mythical Semiramis, who, so tradition says, was transformed into a dove. Of all the objects discovered by the Germans in Mesopotamia this one is of the greatest historical value.

Within the past three months the Germans have gone to the south Babylonian ruin of Warka to begin their excavations in that largest of all the Babylonian mounds. There lived the hero of the Gilgamish epic, and Erech, its ancient name, is mentioned in one of the early chapters of the Bible. Should its excavation be carried on with the same patience and thoroughness with which the Germans have worked at Babylon and Assur, the world may expect discoveries of the greatest interest.


The Ishtar Triumphal Gate. Upon it appears a bull ornament


Granite lion crushing a man or standing over him


Fragments of sun-baked oval vessels.


General view showing Ishtar Gate and processional road.


Ruined edifices erected by Nabopolassar and Nebuchadnezzar II


Trench leading to streets and foundations of Nebuchadnezzar's royal city


The excavations on the mound of the royal capital of Babylon.


Round-roofed tombs of the Assyrians, built of sun-dried square thin bricks.


Excavations on the site of the famous Esagil Temple.


Flooring of the supposed throne hall of Nebuchadnezzar

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THE GERMAN EXCAVATIONS ON THE SITE OF ANCIENT BABYLON.

Inventions New and Interesting

Simple Patent Law, Patent Office News; Notes on Trademarks

A Spring Substitute for a Pneumatic Tire

THE problem of supplying a substitute for the pneumatic tire for the wheels of automobiles is one that is interesting hundreds of inventors and designers of motor cars and anyone who shall succeed in producing a tire which, while having the advantages of a pneumatic tire shall be free of the disadvantages, should reap a reward which when measured in dollars and cents will more than justify the efforts in this direction. We show a wheel which is claimed by the inventor Mr. Axel E. Ellis, to be a perfect substitute for a pneumatic tire embodying what the inventor calls a steel cushion and which it is claimed duplicates in operation the resilient action of a pneumatic tire.

The wheel comprises a rim portion which supports a tire portion composed of segmental sections these parts being made of steel. The segmental sections are pivotally connected to each other and are supported on what is termed a compression resistance mechanism consisting of pivoted levers arranged in pairs, the levers at one end being connected by springs and at their other ends operating through thrust links to force the segmental sections radially outward. The wheel may have a steel tread or the segmental sections may be provided with sectional treads of hard rubber or other material for the purpose of deadening the sound.

The "steel cushion" wheel.

The operation is shown in the sectional views, wherein it is seen that the resistance to compression of any particular section which may be in contact with the ground is not wholly resisted by the parts of the compression resistance mechanism directly acting on that particular section and this is accomplished as will be noted by the interconnecting springs which operate on the levers of adjacent sections, so that the compression of any one section is resisted by the springs, levers and thrust links of adjacent sections.

We are advised that these wheels have been tested on continuous runs over the roads of New York and the New England States, extending upward of three thousand miles, and that a Ford car upon which they were placed was in good shape after the test and the wheels in perfect condition. For heavy truck wheels the treads may be of corrugated steel.

The effort of the inventor of the wheel was to secure a cushion tire as distinguished from a cushion wheel, the latter being objectionable because of the constant eccentricity of the continuous rim to the axle or hub. It is claimed for the Ellis wheel that the action is very similar to a pneumatic tire in that the effort to resist compression is exerted at points adjacent to the point of contact of the tire with the ground, as well as at that point.

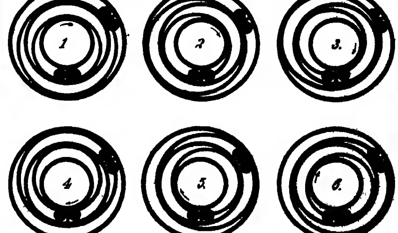
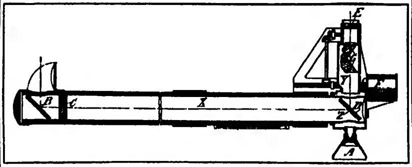


Diagram showing how the pumping is done by the eccentric movement of the annular flanges.

A Single Instrument Range-finder

TWENTY FIVE years ago the British War Office advertised for a single instrument range finder, and this started inventors activities along this particular line. The first instruments employed mechanical methods and depended on the angling of end reflectors with a micrometer to measure the angles to which these reflectors had to be turned in order to train them upon the object. The failure of these instruments was due to the difficulty of cutting the fine threads required. The stereoscopic principle was then employed and then the refracting prism but the difficulty in the latter was that variations in the wave-lengths of the different colors of light produced errors in the reading. Yellow rays predominate if the air is saturated with moisture, red rays if the air be dry, and blue and blue-green rays on a dull cloudy day. The refraction varies of course with the predominating color, and as a result there are serious discrepancies between the readings on bright sunlight days and those on dull days.



Range finder comprising two telescopes with a single eye-piece.

The range finder we now have under consideration, like the original range finder, depends upon mechanical methods of measurement, but it does not contain the limitations of the original range finder for the reason that machine tools of precision have been in the meantime perfected to such an extent as to permit of the desired accuracy of measurements. The improved range finder consists of two telescopes X and Y, one approximately at right angles to the other, but both having the same eyepiece A. The eyepiece is mounted in the side of the fixed telescope tube and the latter contains two reflectors mounted at an angle of forty-five degrees. Rays enter through the side of the fixed telescope and strike the reflector B. Thence they pass through the lens C to the other reflector D, which in turn directs them into the eyepiece. The reflector D has only the lower half of its surface silvered, so that the observer can look through the clear upper portion and see the image brought in through the lens E of the movable telescope. The movable telescope Y is turned on the axis Z by a fine vernier drum P until the object seen through the movable telescope coincides with the object seen through the fixed telescope. The object as seen through the fixed telescope is inverted. When this adjustment has been secured we have a right angle triangle with the axis of the fixed telescope at the base of the triangle and the axis of the movable telescope directed along the hypotenuse. As the base of this triangle is only three feet long, the angle between the axis of the fixed telescope and that of the movable telescope can vary but little from ninety degrees unless the object under observation is very close. If this angle is made 89 degrees 43 minutes the range figures out to 202.21 yards. By moving the telescope through the remaining 17 minutes or 1020 seconds of arc, the range increases from 202.21 yards to infinity. The mechanism must therefore be constructed with such mechanical precision as to make it possible to detect an angle of one second of arc. In order to make the apparatus less bulky, prisms F are introduced into the movable telescope so that it can be materially reduced in length, while it has the same focal length as the fixed telescope. In order to permit of using the range finder at night, the vernier drum is provided with radium buttons at intervals representing fifty yards. The ordinary graduation on the drum can be made to read in 10, 15 or 20 yards.

Improved Vacuum Pump

A VACUUM pump has recently been developed which is unique in that it contains no valves. Instead a novel mechanical movement is employed similar to that of the eccentric of a steam engine. In the body of the pump are formed two annular recesses into which project two annular flanges formed on an overlying plate. This plate, which is known as the "impeller," has an eccentric movement that causes the flanges to roll along the sidewalls of the annular recesses. Like the strap of an eccentric the impeller has a circular movement without revolving about an axis. In other words, each point on the plate describes an orbit with a radius equal to the eccentricity of the plate with respect to the annular recesses. To produce this result, the driving shaft of the pump has an eccentric projection that enters an opening in the center of the impeller. The impeller is prevented from revolving on this center by a guide block adapted to

The vacuum pump with superposed motor

The impeller and the recessed body in which it operates.

slide in a slot in a fixed part of the motor frame. The eccentric projection may be turned to adjust the throw. The power shaft is driven by a motor mounted above the pump and connected thereto by means of a clutch. To prevent heating of the pump, the base is chambered to provide for water circulation.

The manner in which the pump operates is shown in the diagram. The walls of the annular recesses are shown by solid black lines, while the eccentrically moving flanges of the impeller are cross hatched. Each flange with its corresponding recess is a complete pump in itself, being provided with an inlet and an outlet port, as indicated by the black dots. The successive positions of the impeller are shown in the diagram. Fig. 2 shows an advance of sixty degrees over Fig. 1, Fig. 3 an advance of sixty degrees over Fig. 2, and so on, the advance being in the direction of the arrows.

Considering first the inner ring it will be observed that as the points of contact progress in the direction of the arrow, the crescent shaped spaces on the left hand side of the transverse partition are increasing, while that on the right hand side are decreasing, so that air taken in through the left hand port will be discharged through the right hand port. The same is true of all the crescent shaped chambers produced on each side of the outer impeller flange. The parts are revolved in heavy oil, so that there is no danger of leakage. The pump may be used in the laboratory not only for the purpose of producing a high vacuum but also, by leaving the suction side open, for producing a blast for a blowpipe. By reversing the operation of the pump, that is, introducing water under pressure into it, it may be converted into a motor. In fact, it is possible to use one of the impellers as a motor, and the other as a suction pump, for the inlet and exhaust ports may be entirely disconnected. Thus the city water supply may furnish the power to drive one part of the machine while the other is thereby caused to pump air.

Notes for Inventors

A Ball to Break up Deposits in Water Heaters.—In patent No 1,046,591 George T Hickmott of Pontiac, Mich., shows a water heating device comprising a shell externally heated and having inlet and outlet openings and an inclined partition extending partially across it between the openings. A ball is free within the shell and rolls upon its bottom and also on the partition off which it rolls should it be thrown up on the partition by the agitation of the boiling water. The purpose of the ball is to break up deposits of lime on the bottom wall and keep the wall clean and free of coating when hard water is being used.

A Novel Cheese-server.—In patent No 1,046,920, to Elie P Daution of New York, is provided a cheese cutting device having a rod to penetrate the cheese at its middle and a number of independently movable blades which swing upon and are movable longitudinally along the central rod, so that they can be utilized as cutters to cut slices from the cheese and also as a cover for the cut edge of the cheese.

Substitute for the "Kiss of Death" Shuttle.—News comes from Massachusetts that its mill workers are demanding enforcement by the attorney general of that State of the anti-"kiss of death shuttle" law. Along this line it is interesting to note the issue of a patent, No 1,047,957, to Herbert L. Litchfield of Southbridge, Mass., for a shuttle threader which has a stiff, unyielding shank and an extremely flexible, resilient hoop portion at the end of the shank and adapted to enter the eye of the shuttle, the hook portion having at its extremity an open eye and being of such length that when the threader is inserted into the shuttle eye as far as the shank will permit, the open eye of the threader is situated above the shuttle in proper position to receive the thread on the bobbin.

Base Ball Making.—As is well known, base balls are covered by two dumbbell-shaped cover pieces. Frederick H Perry of Beverly, Mass., has secured a patent, No. 1,048,092, for a method of making base balls in which the two dumbbell-shaped cover pieces are applied to a ball center with a layer of cement between the center and covers and a series of wiping blows are delivered against the cover pieces to shape them and cause them to adhere to the ball center, after which the edges of the cover pieces are trimmed and sewed together.

A Machine that Folds and Inserts Sheets in Envelope.—An Atlanta, Georgia, man, William Henry Young, has secured a patent, No 1,046,707 for an apparatus in which a pack of envelopes are held with their flaps opened and a folding machine has a blade which folds a sheet into two parts and then again folds the folded parts and the blade is then engaged with the sheet to insert the folded sheet into the envelope.

A Sanitary Drinking Fountain.—The purpose of patent, No 1,047,762, is evidently to prevent any one from using a sanitary drinking fountain in an unsanitary manner. The patent which issues to H Mueller Manufacturing Company, of Decatur, Ill., as assignor of John C Davis of Dighton, Mass., shows a nozzle which furnishes a drinking jet or bubble and also furnishes means to supply a secondary discharge of liquid so positioned as to wet a person before his face can come in contact with the nozzle, the nozzle being so discharged as to permit the person to drink without receiving a bath.

An Electric Signaling Glove.—In patent No 1,046,225 Charles A Schindler of West Hoboken, N J, combines with a glove, a source of electricity such as a battery carried by the glove and has an electric audible alarm mounted on the glove and an electric lamp also mounted on the glove. Circuit wires connect the source of electricity with the lamp and with the alarm, and spaced contacts for the circuit wires are arranged on certain fingers of the glove and a circuit closing contact on another finger and adapted to engage either of the spaced contacts to close the corresponding circuit so the signals and alarm can be operated at will.

A Car-brake Shoe.—In patent No 1,046,428 to Pittsburgh Brake Shoe Company as assignee of John Jacob Kinzer of Wildwood, Pa., is shown a brake shoe which has an inclosing casing formed of wire fabric and in this fabric is a filling of frictional material with the sides of the casing corrugated.

Some Charles Francis Jenkins Patents. The well-known Washington inventor, Charles Francis Jenkins, has recently issued five patents, one, No. 1,047,527, being for a gas engine starter in which there is a pump casing, plunger and operating crank shaft with a projecting end and a rotary distributor supported upon such end and telescoping the shaft and revoluble thereon with power devices acting between the pump casing and the projecting end of the shaft to rotate the distributor shaft and means for causing the distributor shaft to rotate the crank shaft at will. A second patent, No 1,047,528, is for a motion picture apparatus involving improvements in connection with the projecting machine film box and film drum with a friction disk on the drum shaft and drum-driving devices as specified. A third patent, No 1,047,529 is for a valve for use in connection with an engine cylinder, while a fourth patent, No 1,047,530, is for an apparatus for providing boxes with closures and including a vertical wheel having a series of peripheral radially opened pockets in which receptacles are placed and to which they are delivered laterally, the wheel being rotated step by step and the die and plunger being provided for forming and inserting the closures. The fifth Jenkins patent, No. 1,047,531, is for a valve which is adapted to be opened by fluid pressure from one side and is combined with devices arranged to lock the valve positively in closed position when the pressure is lacking.

Legal Notes

Failure to Testify and the Presumption it Raises.—The case of Steinberger v Hewlett decided by First Assistant Commissioner Billings, presents some peculiar questions. It was an interference between two sole applicants and the Commissioner said that viewing the cases merely as those of two independent inventors "it is very clear that Steinberger would fail." But it appeared from the record that a joint application was filed by one Buck and the party Hewlett for the invention of the issue prior to the sole application of Hewlett, which joint application became abandoned. It was contended by Steinberger in his testimony that he disclosed the invention to the party Buck and that the records of the Patent Office placed in evidence raised the presumption that Buck disclosed the invention to Hewlett. Hewlett elected to present no testimony so that no testimony is presented in his behalf to rebut the presumption claimed in behalf of Steinberger.

The Commissioner said that "where in a case involving the question of originality, an inventor fails to take the stand who is available as a witness when the facts in his favor, if any there be, are peculiarly within his knowledge, the legal presumption follows that his testimony would be unfavorable to his case" and reversed the decision of the Examiners in Chief and held Steinberger to be the original inventor of the issue.

Recently Adjudicated Patents.—Of nine adjudicated cases in a recent list, the DeMoulin patent No 555,499 for initiation apparatus for secret societies was held void for lack of patentable novelty in Alexander v DeMoulin Brothers & Co, 199 Fed Rep., 145. Claim 2 of the Steinmetz patent, No 559 913, for an alternating current system of distribution was held not infringed in General Electric Company v Allis-Chalmers Company, 199 Fed Rep, 169, the Baldwin patent No 656,874 for an acetylene gas-generator lamp was held valid and infringed as to claim 1 but not infringed as to claims 2, 3, 4, 5, 6 and 10 in Bleser v Baldwin, 199 Fed Rep, 133, the Van Auken patent, No 828,153, for discharge valve for steam-radiator was held not anticipated and valid but not infringed in Monash-Younker Company v Van Auken, 199 Fed Rep, 123, the Eggleston patent, No 838,394 for a relief device for water systems was held valid and infringed in Eggleston v Milwaukee Heater Manufacturing Company, 199 Fed Rep, 147, the Boldt design patent, No 39,921, for a design for a bottle was held void on its face for lack of patentable invention in Charles Boldt Company v Turner Brothers Company, 199 Fed. Rep, 139, and The Evans design patent, No 41 785, for a design for a lamp-shade was held valid and infringed in Macbeth-Evans Glass Company v Rosenbaum Company, 199 Fed Rep 154. The Webster design patent, No 40 789, for a design for a clothes brush, has been held valid and infringed in Foster & Brother Company v Tilden-Thurber Company, 200 Fed Rep, 54, the Redington patent, No 625,517, for a mucilage holder has been held not infringed in Redington v Office Equipment Company, 200 Fed Rep, 57, the Wurt's patent, No 570,410, for a circuit interrupting device, has been held, as to claims 3 and 4, void for lack of patentable invention in Condit Electric Manufacturing Company v Westinghouse Electric and Manufacturing Company, 200 Fed Rep, 144, the Carleton patent, No 481,254, for a hair clipper, has been construed and held not infringed in Brown & Sharpe Manufacturing Company v Coates Clipper Manufacturing Company, 200 Fed Rep, 149, the Joy patent, No 780,664, for a printing telegraph receiver, as to claim 12 as modified and limited by the disclaimer filed, has been held valid and infringed in Page Machine Company v Dow, Jones & Co, 200 Fed Rep., 72, and Gale patent, No 685,328, for rubbing and polishing machine, has been held valid and infringed in Moore Carving Machine Company v Lucas Machine Company, 200 Fed. Rep, 77.

Trade-mark Notes

"Bona Fide" Refused Registration.—First Assistant Commissioner Billings in *ex parte* Eisenstadt Manufacturing Company has refused registration of the words "Bona Fide" as a trade-mark for music boxes, watches, etc since these words would indicate to the average purchaser that the goods upon which they are placed are genuine and that the mark is therefore descriptive.

Tire and Automobiles Not the Same Goods.—In the case of G and J Tire v G J G Motor Car Company First Assistant Commissioner Billings has held that rubber tires and automobiles are not goods of the same descriptive properties and that the use of a mark upon tires was no bar to the use of the same mark upon automobiles by another.

No Appeal to Court of Appeals in Trade-mark Renewals.—The Court of Appeals of the District of Columbia by Mr Justice Van Orsdel in the case of the Standard Oil Company of New York, has held that under the provisions of the Trade-mark Act of 1905 no appeal lies to the Court of Appeals of the District of Columbia from the decision of the Commissioner of Patents refusing to renew the registration of a trade-mark.

Recording Trade-mark Assignments.—First Assistant Commissioner of Patents Billings in disposing of the petition of the Alart & McGuire Company has held that an assignment of a trade-mark is not recordable, which while purporting to convey the good will of the business obviously retains in the assignor title to a business which is not segregable from that attempted to be transferred. At the same time, he holds that an assignment of a registered trade-mark must be recorded merely because it does not transfer the good will of the business as to all the goods set up in the registration, where the goods mentioned in the assignment are so different from the other goods named in the registration certificate, that the business in the one is segregable from that in the other. He also holds that in considering this question all reasonable doubts should be resolved in favor of recording the assignment.

World-wide Trade Marks.—There is a movement on foot seeking to secure the world-wide recognition of trade-marks. How far this will meet with favor among the commercial nations of the world remains to be seen. By a resolution passed at the Newcastle meeting of the Association of British Chambers of Commerce, the British Government has been urged, in a letter addressed to the Secretary of State for Foreign Affairs by the Association's secretary, to press upon foreign governments the necessity of establishing as an international law that 'first public use' shall be the fundamental condition of ownership of a trade-mark. In some countries priority of registration excludes use by owners, and user antedates the registration. It is promised that the subject shall be brought up for decision at the next International Conference for the Protection of Industrial Property.

The Amended Trade-mark Act.—In the amendment enacted and approved in the early part of this year to the trade-mark statute, it is provided that no mark shall be registered which consists of or comprises any name, distinguishing mark, character, emblem, colors, flag or banner adopted by any institution, organization, club, or society which was incorporated in any State in the United States prior to the date of adoption and use by the applicant; provided that said name, distinguishing mark, character, emblem, colors, flag or banner was adopted and publicly used by said institution, organization, club, or society prior to the date of adoption and use by the applicant. The effect of this will doubtless be to enable any institution, etc., incorporated as specified and having used the mark as set forth in the statute to oppose and prevent the registration by a subsequent adopter of the mark.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Of Interest to Farmers.

ATTACHMENT FOR GATES.—J. GERST, care of W. P. Gerst, Alton, Iowa. The intention in this case is to provide means by which a swinging gate may be raised or lowered at will. A further object is the provision of means for raising and lowering a gate and for maintaining the same at any desired height.

CORN PLANTER.—A. F. STAAB, 177 W. 37th St., Los Angeles, Cal. This invention provides a planter arranged to plant or drill a plurality of rows at one time to properly prepare the ground for the reception of the seeds and to subsequently cover the seed to insure a ready germination thereof.

Of General Interest.

METER BOX AND METER CONNECTION.—W. HANNA, care of E. A. Hart, Water Works Dept., Henderson, Ky. This inventor provides connecting means for use in a meter box adapted to contain any of the standard meters for water or gas, the construction being such that it is only necessary to have the box large enough to admit the meter, since the connection set forth which engages the meter requires no extended labor or time in placing the meter in service or in removing it therefrom.

DEVICE FOR MOUNTING ARTIFICIAL PEARLS.—G. BRUNET, Herblay, Dept. of Seine-et-Oise, and L. APRA, No. 11 Rue Pastourelle, Paris, France. In the present patent the invention has reference to a novel means for securing an artificial pearl to the stem or shank of a stick pin or like device in order that the pearl may be securely fastened while at the same time the fastener elements will be effectually concealed.

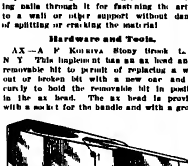
PLASTIC MATERIAL.—H. BIZZARRI, 58 Spring St., New York, N. Y. This inventor provides a material for the formation of the heads, bodies and limbs of dolls, ornaments, statues or other articles for decorative and other purposes, which is homogeneous throughout, practically indestructible, exceedingly

A FIGURE OF PLASTIC MATERIAL.

light, not unduly influenced by moisture, heat or cold, and capable of being readily molded into any desired shape and sufficiently soft to permit cutting or chiseling the same or driving nails through it for fastening the article to a wall or other support without danger of splitting or cracking the material.

Hardware and Tools.

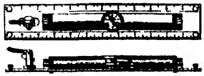
AX.—A. F. KOLBIVA, Stony Brook, L. I., N. Y. This implement has an ax head and a removable bit to permit of replacing a worn out or broken bit with a new one and securely to hold the removable bit in position in the ax head. The ax head is provided with a socket for the handle and with a groove



AX

for the reception of the back of the bit, the groove being provided with a socket for the handle and with a groove for the reception of the back of the bit, the groove being provided with beveled seats and the back of the bit with beveled lugs adapted to engage the seat to center the bit on the ax head and to hold the bit against accidental movement in an up and down direction.

PARALLEL PROTRACTOR.—C. P. HAGEN, care of U. S. Surveyor General's Office, Reno, Nevada. The protractor consists of a body mounted on a pair of milled rollers rigidly attached to a connecting shaft. In the middle of the instrument an indicator is mounted whose pointer is turned by a gear attached to the shaft connecting the two rollers. At one end is a lever attached to a cam which works on a pin, and when the lever is lowered, the pin coming in contact with the drawing board raises that end of the instrument which now revolves in a circle, the pin as a center. The

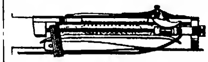


PARALLEL PROTRACTOR.

indicator announces the number of degrees being turned off, and when the desired angle is reached the lever is raised. The instrument now rolls to the point from which the line is to be drawn. Means permit lines several times the protractor's length to be drawn. They slide either way and are graduated on both upper and lower faces to different scales. They are interchangeable and give four different scales. It is especially for field work, and will plat without a vernier to one minute of arc.

Machines and Mechanical Devices.

PICKER HEAD CHECK.—A. A. PERKINS, care of Liverpool, London and Globe Ins. Co., Sanford, Maine. This invention relates to looms, and its object is to provide a head check arranged to stop the picker head and hold it in proper place for receiving the im-

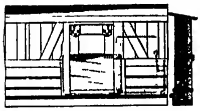


PICKER HEAD CHECK

pact of the returning shuttle. For this purpose use is made of a spring-pressed cam mounted on the shuttle box and adapted to be engaged by the picker head to hold the latter in an outermost or receiving position for the shuttle.

Railways and Their Accessories.

ADJUSTABLE GRAIN DOOR.—H. W. F. JABUSS, 1127 E. 71st St., Cleveland, Ohio. This invention has reference to improvements in doors for cars designed to carry grain and has for an object an improved structure which

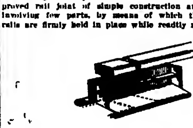


ADJUSTABLE GRAIN DOOR.

may be adjusted or expanded so as to permit grain of different weights to be shipped in the same car without changing the door and without reducing the amount of grain which may be safely shipped in any particular car.

TEMPORARY TIE HOLDING DEVICE.—H. A. WITKIN and J. A. FREMON, Leeper, Mo. This invention provides a device possessing sufficient resiliency to withstand the shocks while the spikes are being driven into the tie. It provides a device with which the tie may be brought against the base plate of the rail in a perfectly vertical direction and held there automatically until attached to the rail.

RAIL JOINT.—A. W. STEKKINS, Abbeville, La. In the present patent the invention has for its object the provision of a new and improved rail joint of simple construction and involving few parts, by means of which the rails are firmly held in place while readily re-

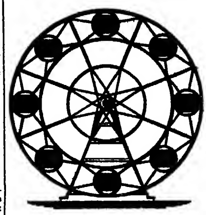


RAIL JOINT

sponsive to any expansion and contraction. In the accompanying illustration is clearly shown a perspective view of a rail joint embodying the invention.

Pertaining to Recreation.

OBSERVATION CAR.—A. F. SLAVIN, 1462 Third Ave., Manhattan, N. Y., N. Y. An object of the invention is to provide an observation wheel with a plurality of independently rotating cars arranged to remain in a vertical position by gravity and by such action trans-



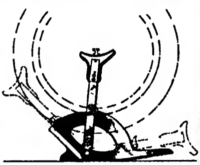
OBSERVATION CAR.

mit power to propelling mechanism for propelling the car a certain number of turns in one direction in a horizontal plane and then a certain number of turns in an opposite direction.

Pertaining to Vehicles.

SHOCK ABSORBER.—C. W. SNOWDEN, Isabel, Guantanamo, Cuba. This invention relates to attachments for vehicles, particularly motor driven vehicles, to absorb the severe shocks to which the vehicle is subjected, the absorber acting to take up the vibrations due to the yielding and recoil of the springs supporting the vehicle body.

VEHICLE JACK.—W. T. ADAMS, care of W. T. Adams Machine Co., Corinth, Miss. This improved jack is adapted for lifting wheels of vehicles, especially automobiles, when the vehicles are run over a jack, so that the latter engages the axles. The block may be



VEHICLE JACK.

adjusted higher or lower as may be required to accommodate the jack to different vehicles and when the jack is not in use the axle support may be turned down to the right, as indicated by dotted lines in the engraving, and thus the jack as a whole will occupy comparatively small space and may be conveniently carried in the auto or other vehicle when required.

Designs.

DESIGN FOR A SERVING TABLE.—L. A. FAIRHOLE, 411 W. 44th St., Manhattan, N. Y., N. Y. In this ornamental design for a serving table the form of the article is made on simple yet very graceful lines. Two drawers are in front, a shelf for use in resting ware projects from either end and a shelf for use in holding empty dishes is under the top of the table and supported by the four legs.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INQUIRY COLUMN

Inquiry No. 9596. Wanted the name and address of a manufacturer of spun glass.

Inquiry No. 9598. Wanted the names and addresses of concerns who can turn irregular shaped handles in wood similar to gun-stock work.

Inquiry No. 9599. Wanted name and address of the maker of a machine for driving fence posts into the ground.

Inquiry No. 9600. Wanted the name and address of a maker of a patented keyless door lock.

Inquiry No. 9601. Wanted the names and addresses of a few concerns who can do machine embroidery according to the design furnished, at reasonable rates.

Inquiry No. 9602. Wanted the address of the manufacturer of the Greenfield flexible armored conductors or cables. This is a double galvanized spiral conductor or cable.

Inquiry No. 9603. Wanted the name of manufacturer who could make newly patented articles [illegible] from 12 to 25 gage sheet aluminum.

Inquiry No. 9604. Wanted the names and addresses of manufacturers of a special hand [illegible] cleaning machine on the order of a carpet cleaning machine.

Inquiry No. 9605. Wanted the name and address of concerns making paper [illegible].

Inquiry No. 9606. Wanted [illegible] and other [illegible] to [illegible] stores. [illegible] to buy wholesale.

Inquiry No. 9607. [illegible]

Inquiry No. 9608. [illegible]

The Decline of Native Forest Trees in Cities

Some Means of Prevention

By Myron H. West

A VERY obvious and deplorable fact concerning our native forest trees, which have been forced to undergo artificial environment and exist amid unnatural conditions, is found in their tendency to degenerate and in many cases to die out altogether Where once bordering our streets, in the public parks and on private estates, fine old native trees flourished, now are to be seen in many cases only small nursery grown specimens which fail utterly to give that effect of grandeur and that enchanting historic suggestiveness which was so true while their places were filled with the picturesque conifers, the gnarled oaks and the grand old specimens of ash, cherry and elm.

It is oftentimes difficult to determine the exact cause responsible for such tree decline, especially in view of the fact that younger trees transplanted from a nursery often thrive in the same conditions. In many cases, however, it may be attributed to soil and drainage conditions which have undergone a marked change with the building of lawns, streets and other improvements. Root systems are oftentimes mutilated to an irreparable extent by the building of foundations to houses, the installing of curbs and by laying of water, gas and drainage pipes. In such cases care could be taken to make smooth cuts and paint or tar the surfaces, so that much loss of sap would be prevented and the tree saved a material loss. It is also a wise procedure to prune back a tree thus mutilated so that the amount of evaporating surface of the leaves would tend to balance the decreased root system.

In the changes of soil condition from those existing in the original forest lies perhaps as potent a danger as any to tree life In its natural state, the forest floor was covered with a thick mat of decayed leaves and twigs forming a sponge-like material which retained the moisture, and in its lower stratum furnished an abundance of well prepared, easily assimilated food material It was also a non-conductor and extremes of heat and cold were not easily transmitted to the tender feeding rootlets attracted to it from the lower depths. In the grading and seeding of lawns, this ideal condition for tree growth is done away with and a hard tramped surface, covered only with short cropped grass, takes the place of the loose, nutritious and moisture retaining mulching. Whereas lawns may be kept green by repeated sprinkling, rarely do the tree roots get enough moisture under such conditions.

In watering trees, the hose should be allowed to run until the lawn is flooded, and the water has permeated to a depth of two feet But wherever possible the natural conditions once prevailing should be replaced. Spade the ground around the old tree out to a distance of fifteen feet or so, as far as the branches extend, and spread on this area a layer of well rotted leaves or compost six inches thick Herein plant periwinkle, ferns or ivy, something to form a thick ground cover This will restore a semblance of natural woodland attractiveness and prove a boon to the suffering tree

Oftentimes the lowering of the natural water table, the level at which free water stands, interferes with the vitality of the trees. This often occurs by reason of installing sewer or drainage systems. Proper precautions taken relative to conserving the surface moisture will, however, obviate this difficulty to a great extent Where street pavements and sidewalks have resulted in covering a large proportion of the root system, unusual precautions are necessary to maintain tree health. Air and water may be supplied to the roots in such cases by installing a radiating system of land tile leading from a common center to all parts of the root area.

Next to the changing of soil conditions perhaps the greatest agencies for tree destruction are smoke and gas. These ener-

ing in cities soon become covered with soot, the oily, adhesive substance filling the stomata of the leaves and rendering them unable to properly fulfill their function of interchanging oxygen and carbonic acid gas. The leaf structure of certain species of trees enables them to cope more successfully with this danger than is true of others, and this fact should be considered in planting trees in smoky districts. To safeguard existing trees, washing should be resorted to, a thorough spraying with soap and soft water, followed with a more forceful rinsing of clear water, will free the leaves of most of the accumulative soot.

Gas from leaky pipes is a danger for which one should be ever on the alert A tiny leak for a long time is perhaps the most dangerous on account of the difficulty of detection and the sureness of destructive results A tree affected by gas poisoning usually first shows signs of sickness in the top branches, the leaves early turning yellow and falling, the bark begins to loosen and to become infested with fungi. Borers begin their operations and a sour repugnant odor is discernible Although rarely possible to save the life of a tree in an advanced stage of poisoning, heroic efforts taken during the early symptoms may succeed. First remove the cause by installing new gas pipes, if possible at a more remote distance from the tree. Replace the soil from over and around the roots This should be carried out with extreme care, uncovering a part of the root system at a time, soaking the under layer of the earth generously with water and replacing the soil removed with a fresh fertile mixture of well rotted compost and top soil with an admixture of sand where necessary to produce the proper mechanical conditions. The tree should then be sprayed for insects and fungi and carefully pruned. A thorough watering should be given twice a week throughout the summer Oftentimes borers attack gas affected trees with unusual frequency Spraying with a solution of whale oil soap during the summer will prevent the female beetles from laying their eggs and later, in September or October while the young grubs are operating just under the bark, they may be detected by the fresh wood dust and killed by following their burrows with a soft wire or by injecting a little carbon bisulphide with a medicine dropper and stopping the orifice with putty and clay The attacks from insects and fungi are usually secondary to more important reasons for the tree decline and should receive careful attention in the work of rejuvenation as they are loath to leave the host after its health has been otherwise restored

The two great groups of parasitic insects, the leaf eaters and the sucking or scale insects, may be brought into subjection usually by careful applications of stomach and contact poisons, respectively but a knowledge of insect life and habits is necessary to successfully undertake such work.

Electric currents from wires coming in contact with wet branches often kill or mutilate trees and mechanical abrasions such as caused by horses, lawn mowers and the like are productive of great harm

It is reasonable to assume that unusual ailments brought about through the advent of artificial conditions and environs should be met with artificial methods of treatment, a fact which has led to the development in recent years of a specialized line of work commonly known for want of a better term as "tree doctoring" or "tree surgery Like all other avenues of endeavor it is likely to be productive of quacks as well as of skilled and efficient practitioners. There is no doubt that through the efforts of this new department of agriculture, many valuable old trees have been saved to future generations. In tree surgery as in human surgery, there is often, however, a tendency to over-operate.

Pruning of ornamental trees should be limited in most cases to the taking off of dead branches. Seldom is there any need of doing more save in cases where branches cross or interfere or where they interfere with desired vistas. To remove

dead or dying limbs is, of course, but a matter of good housekeeping, but should be carried out intelligently, for a tree once mutilated must stand on for years in mute reproach to the perpetrator of the act. Limbs should be cut off in a line with the trunk in such a way as to present the side of the cut in direct contact with the downward flow of elaborated sap. Start the cut from the underside to prevent stripping the bark and paint the wounds with a mixture of white lead and boiled linseed oil but not with the cheaper brands of prepared paint Where decay has penetrated the tree, clean out all rotted matter following into the hardwood until all fungus mycelia have been removed. Form the cavity in such a way that it will enlarge as it recedes from the opening at all points except at the bottom, where it should slope downward and outward to allow the draining of any sap or moisture which may collect behind the filling. Treat the interior of the cavity with the exception of the area near the opening with creosote and fill with concrete colored a dark gray with lamp-black carrying the surface well back and even with the cambium layer and leaving it slightly convex in shape In large cavities, steel reinforcement should be used and the cement inserted in sections separated with tar so that the swaying of the tree will result in a slight opening of the joints rather than in cracking of the concrete Although filling cavities in trees only results in forming a mechanical support the process of filling should be carried out along strictly scientific lines, following engineering rules and at the same time doing the work with the care and precaution that a dentist would use in filling a tooth A filling with cement when not properly made is probably of more danger to the tree than good unless the cavity is thoroughly cleaned and disinfected The space behind the filling becomes a veritable breeding ground for parasitic fungi and insects, resulting in the ultimate destruction of the tree This is especially true in the case where the cavities are thoroughly covered over with sheets of metal.

The process of bolting and supporting trees by mechanical means is one which may be carried to extremes, the danger being that by the insertion of too many bolts of too large a diameter the branches are weakened instead of strengthened Bolts should always be placed through the limbs instead of around as bands, and should only be of sufficient size to furnish necessary support They should be formed with a link midway between the ends to take up the motion caused by the swaying of the trees. The heads should be counter sunk and set in tar or asphalt to prevent fungus spores from entering alongside the bolt It is usually only necessary to bolt together limbs which spring from crotches which have become split or weakened The tying together of tree limbs with a maze of iron rods is always unsightly and usually it is not necessary

Oftentimes trees or groups of trees become of great value by reason of their size, beauty, location or historic connections, but they are usually worth far more to their owner and to the public at large than merely what corresponds with these virtues and the matter of prolonging the life and beauty of fine old trees becomes well nigh a matter of civic duty in various cities, and cannot be too strongly commended

How the Indians Harvest Wild Rice

A REPORT from the American consul at Kingston Ontario, gives a graphic account of the wild rice harvest, which was in progress at the time of writing along the shores of Rice Lake, lying a few miles north of Cobourg. Here, as in other parts of southern Canada, and in Minnesota and Wisconsin, the gathering of wild rice is the peculiar prerogative of the Indians, who from time immemorial have used this grain as one of their principal foods, besides selling it to the whites. In pioneer days, it was a common food of the European settlers, especially those engaged in the fur trade. In more recent times it has come to be regarded as a luxury by white people, as it sells for two or three times as much as ordinary white rice In this country Chicago is still an important market for wild rice

This plant (*Zizania aquatica*) is, of course, quite different botanically from true rice It has a long black grain, and hence is sometimes called black rice but it has scores of other names in English French and the Indian tongues. According to Dr Jenks, the principal authority on this plant, "more geographic names have been derived from wild rice than from any other natural vegetal product throughout the whole continent" The Menominee Indians derive their name from it It is the most nutritious cereal in America and many attempts have been made to extend its cultivation but without much success. To the average American it is probably best known as a favorite food of wild ducks and other water fowl

In harvesting this grain the Indians use the same simple methods that were followed by their remote ancestors. We quote from the consul's description as follows

"In gathering sheets are laid in the bottom of the canoe and a start is made for the rice beds. A man sits in the bow of the boat and paddles while his helpmate takes up a position in the stern and with the aid of two stout sticks bends the stalks over the canoe and thrashes the rice into the bottom of the boat This continues until the boat is nearly full when the rice is taken to shore and spread out to dry After a few hours in the hot sun the grain is ready for parching This is usually done by the women who place it in a large iron pot and heat it over a slow fire stirring it continually until it is parched It is then ready for threshing This is done by one of the men putting it in an iron pot or large wooden bowl hollowed out of a log and with moccasins on his feet and trousers tied tightly around his ankles, he jumps on it until the grain is separated from the chaff The last operation is that of sifting The rice is poured into birch bark baskets, in small quantities, and squatting down in front of the tents on the shore, under the trees, or any place where there is a good breeze the women gently shake until the chaff is separated from the grain and is blown away by the wind Crude as it may seem it is exceedingly effective and the workers are scrupulously clean throughout the whole process"

Protection of Ocean Liners by Subdivision

(Concluded from page 356)

security throughout the central portions of the length of the ship against flooding of the boiler and engine room spaces.

The new construction that has been put into the Imperator' consists in the construction of an inner skin, from 3 to 4½ feet from the outer skin which extends from the bulkhead at the forward end of the boiler room spaces, clear to the bow, and reaches from the floor of the ship to several feet above the load water line We present a photographic view of this work, which shows at the left the sloping outer skin at the bow of the ship and at the right the new interior skin. It will be noted that the heavy framing of this inner skin is well calculated to stand heavy water pressure, in the event of flooding through injury An additional precaution has been the construction of two large trimming tanks aft of the peak tank, which extend the full width of the ship and are closed in by watertight steel floats, approximately at the load water line of the ship

Both of these companies are to be congratulated upon the promptitude with which they have applied the lesson of last year's disaster, and the very thorough manner in which the two great ships have been rendered secure against sinking through under-water damage of any description.

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents subscriptions, books, etc This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12777) M R. writes First, given two surfaces one plain the other corrugated but the same dimensions The area or square surface exposed of the first surface is greater than that of the second Each is in contact with the air on one side only then, will the atmospheric pressure be greater on the first than on the second or will it be the same on both? A The atmospheric pressure is the same on both the level and the corrugated surface The reason is that only that component of the pressure acts directly upon the surface which is at right angles to the surface It is the same idea as this that no more houses can be built or trees set out on a side hill than could be on the level plain which would be made by removing the hill 2 Is the same amount of energy expended in the complete operation of raising a hundred-pound weight a height of ten feet when pulleys or tackles are used as is expended when the weight is lifted without them, as by direct application of the hands to the weight? Also give the answer in regard to the same operation when performed with the aid of levers A If you can lift a weight up to the place where you want it there is no advantage in employing a machine to raise it It matters not whether a lever or pulley or any other machine be used. A machine enables a man to raise a weight heavier than he can lift by his own power but he must move it more slowly in exactly the same ratio as it is greater than he can raise by his own effort alone. No machine creates power It wastes power by its friction and the power used in running it.

(12778) J S. N asks Will you please advise me in your Answers to Queries if the North Magnetic Pole is situated in latitude 70 degrees north and longitude 97 degrees west? Is the South Magnetic Pole situated exactly opposite, which would make it 70 degrees south latitude and 83 degrees east longitude? When the North Magnetic Pole varies its position does the South Magnetic Pole shift with it so that they always maintain positions exactly opposite on the earth's surface? A The earth's North Magnetic Pole was visited in 1831 by Sir J C Ross and located in latitude 70 degrees 5 minutes north and longitude 96 degrees 46 minutes west It was next visited by Amundsen in 1907 and was found to be in latitude 75 degrees 5 minutes north and longitude 96 degrees 47 minutes west The South Magnetic Pole was located by Lieut Shackleton's party in 1909 in latitude 72 degrees 25 minutes south and longitude 155 degrees 4 minutes east No further data are accessible We shall have to wait for a visit by other explorers before we can know about changes Our figures for the location of the South Magnetic Pole are taken from the *National Geographic Magazine* April 1909 page 401 where there is a misprint in the longitude You will see that the South Magnetic Pole is not diametrically opposite the North Magnetic Pole

(12779) J B W writes In your Notes and Queries of February 1st, 1913 (12741) R E P asks Where did these worms come from? Your answer was, you could not account for the fall of worms as described also that it was not probable that a scientist could give a better explanation than a common-sense man. In your issue of March 1st 1913 (12753) C W B says there are no hatcheries in the clouds for breeding angleworms toads or frogs, and their sudden appearance has developed the popular fallacy that they have rained down Will C W B explain then how angleworms, toads and little red lizards got up on a trestle eighty feet from the ground where I found them? Had the angleworms been in the hot planks before the shower of rain that brought them they would have been fried to a crisp. Again, I would ask How did those angleworms get into our rain barrels? Did they not come from the house roof with the rain through the conductor into the barrels? A. Credible witnesses have testified to such occurrences as the above too many times for the matter to be laughed out of court. So we close this discussion by saying as we said at first that each instance must be carefully scrutinized and judged by itself Nor should we decide that these small creatures came from the clouds if there is any other way for them to appear

(12780) W R. asks Will you have the kindness to get me through your valuable columns the opinion of your authority on languages on the following subject? I have been informed that the vocabulary of the German language comprises about *twice* the number of words which are contained in the vocabulary of the English language. To prove this, it was said that the new Murray's "Dictionary of the English Language is supposed to have 250 000 words, while the Grimm's 'Woerterbuch der Deutschen Sprache" after completion will have about one half of a million expressions. I should like to be informed whether this statement finds your approval, and thank you in advance for your courtesy in answering through your publication. A. We can give no decision as to the relative number of words in the German and English languages. We referred it to a college professor in English, and he said that a decision was impossible The "New Dictionary of the English Language is not anywhere near completion and many of the added words in this truly standard work are words from old writers, not now in use the German dictionaries contain many phrases and words made in the peculiar German fashion by stringing words together in a line, as it were to form one compound term. This every scholar knows. A numerical comparison of the two tongues seems out of the question A standard of enumeration seems to be required for counting words. Rules to be a guide for determining whether a word shall be counted or not ought first to be agreed upon before such a comparison can be made It is just like the claim among the different candidates for first place among English dictionaries. Each publisher determines his own standard and announces that his work is first in the points which he has decided are the chief points of superiority

(12781) R M B asks Will you be good enough to tell me what scientific basis if any there is in the theory that to insure health from proper circulation one should sleep only with the head to the north, or at least to the south? I understand that in a general sense it is supposed to be the rotation of the earth that one should lie with head and feet toward the poles etc. but in actual practical experience is it scientifically *proven* that this acts beneficially and the reverse position is hurtful? A We know of nothing whatever in science to give support to the theory that one will maintain better health by sleeping with his head to the north and the body along the north and south line. It may be so We cannot prove that it is not so Many believe it to be so We do not see how any one can carry out this practice in a sleeping car Probably there are more who sleep in other positions than who sleep in the meridian Nor do we suppose that health is the sole possession of those who sleep in the north and south line If there is any basis for this belief it would we think be due to the earth electric currents, rather than to gravitation or centrifugal force.

(12782) A D asks What is the ratio of expansion of water into steam? A Water expands about 1 700 volumes in changing into steam so that it is a common expression that a cubic inch of water makes a cubic foot of steam At 212 deg Fahr and normal pressure the weight of a cubic foot of steam as given by Kent, in his Mechanical Engineers Pocket Book price $5 is 0.03732 pound and the weight of a cubic foot of water is 62 4 pounds. This would give an expansion of 1 675 volumes.

(12783) W S asks 1 Does brass expand or contract with heat? A Brass expands in length about 0.002 for a change of 1 deg Cent. 2 What is the pressure of freezing water per square inch? A The freezing point of water is lowered 0 0072 degree per atmosphere of increased pressure up to 700 atmospheres, as was proved experimentally by Sir James Dewar Hence under a pressure of 1 000 atmospheres, or about 15,000 pounds per square inch, water would not freeze at a temperature of 7.2 deg Cent. It would also be inferred from this that this pressure would melt ice at this temperature. A rough statement of this fact is that one ton per square inch lowers the freezing point 1 deg Cent 3 What is the exact atmosphere pressure per square inch at sea level? A The normal barometer at sea level is taken as 29 92 inches of mercury or 14 7 pounds pressure per square inch. 4 How many metals if any contract with heat? A There is no metal which contracts with heating There are some alloys which have so small a coefficient of expansion that it is negligible for any ordinary length An alloy consisting of 36 per cent nickel and 64 per cent iron has so small an expansion that 19 miles of it would expand only one inch for a change of 1 deg Fahr This is called invar Pendulums and measures made of it may be taken as invariable in length for any moderate change of temperature Solid silver iodide contracts upon heating between −60 degrees and +142 degrees, according to Ganot's "Physics, edition of 1910 page 313 Stretched India rubber also contracts when heated.

(12784) R. R. W asks Will you please advise me as to the following If the Pacific Ocean at the western end of the Panama Canal is higher than the Atlantic Ocean at the eastern end, and also how much higher A. The Atlantic and Pacific oceans are at the same mean level at the two ends of the Panama Canal, but the tides at the Pacific end are 20 feet, rising and falling 10 feet each way from mean sea level, and at the Atlantic end the tides are about 18 inches, the water rising and falling 9 inches from mean sea level. These figures are furnished us by the Isthmian Canal Commission Your designation of the ends of the canal as eastern and western is not quite correct, because the Atlantic end of the canal is farther west than is the Pacific end. Colon is farther west than Panama. The canal lies in a general direction northwest and southeast, with the southeast end at Panama on the Pacific Ocean. The Isthmus, where the canal cuts it, runs northeast and southwest.

NEW BOOKS, ETC.

THE GRAMMAR OF SCIENCE. By Karl Pearson, M.A., S.R.S., Professor of Applied Mathematics and Mechanics, University College, London Part 1 Physical Third edition, revised and enlarged London Adam & Charles Black, 1911

Ten years ago Pearson's 'Grammar of Science was regarded almost as a revolutionary book Its bold abandonment of 'matter' and force as fundamentals in science gave rise to a hot controversy Most of us are now prepared to agree with Prof Pearson where twenty years ago we would have been inclined to differ During that period science has become more idealistic. As Prof Pearson says No one believes now that science *explains* anything we all look upon it as a shorthand description as an economy of thought In this new edition of The Grammar of Science, the author tells us ' All that it has been possible to do has been to add a chapter indicating what the author thinks to be the expansion taking place in our ideas of causation For Prof Pearson believes that beyond such discarded fundamentals as matter and 'force lies still another fetish amid the inscrutable arcana of even modern science, namely, the category of cause and effect *Is this* category anything but a conceptual limit to experience, and without any basis in perception beyond a statistical approximation? In a chapter on modern physical ideas, the author indicates that the physicists are discovering a new perceptual reality but that they are seeking for a mathematical concept wide enough to describe a much enlarged perceptual experience. Because of these two new sections the book had to be divided into two parts

PHYSIOLOGICAL OPTICS By George J Burch, M A, D Sc Oxon, S R S. Oxford The Clarendon Press, 1912

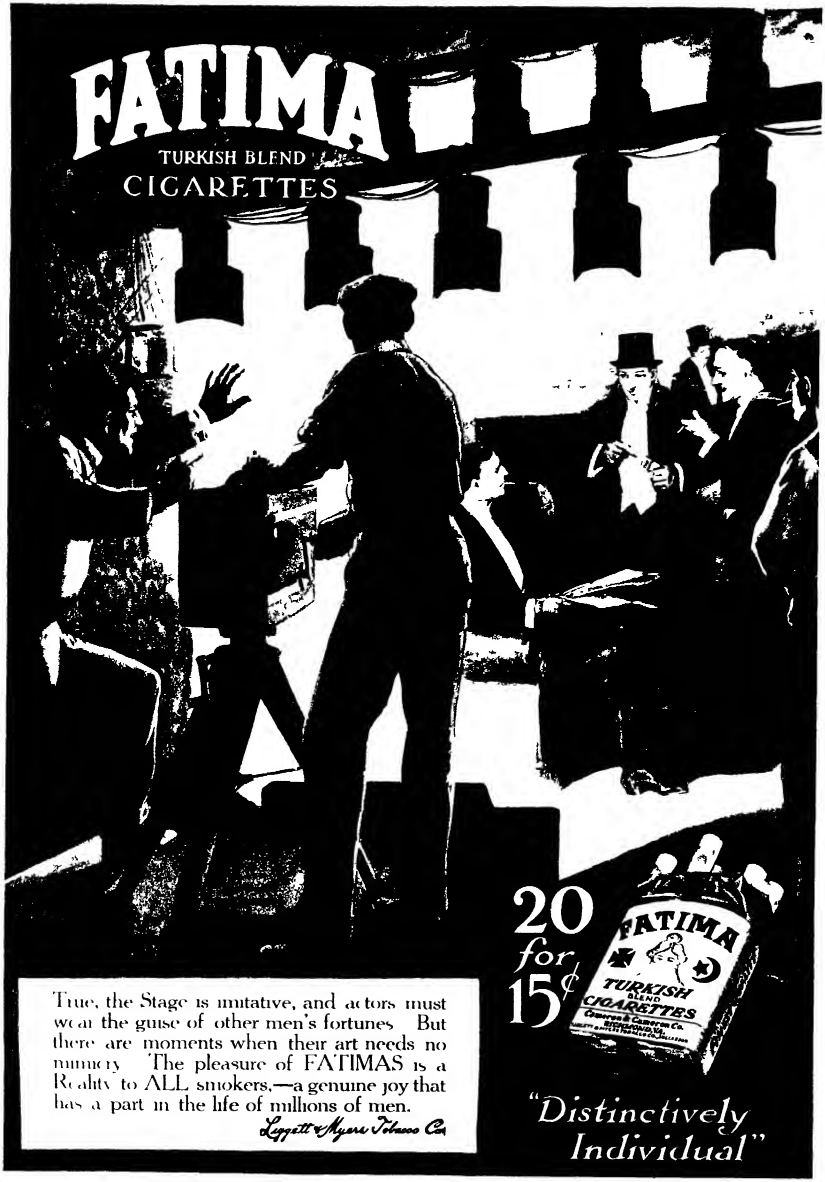
The author of this book has conducted classes in physiological optics at Oxford in the course required by the regulations for the diploma in ophthalmology of the University Written as it is for a special institution and for a special course it may not meet all the requirements of other institutions. Still the descriptions are for the most part so general that other teachers will surely find the book of use The instructions given are intended to make the student to a great extent independent of frequent reference to the demonstrator The experiments vary in complexity Some require but a few minutes only others, several hours The author has distinguished those which are very important from those less so by means of asterisks The six sections of the book bear the following headings Dioptrics Dioptrics of the Eye, Judgments of the Eye Space Sensations of the Eye Measurements of Color Sensations, Experiments by Flashing Light. The book may be commended for its excellent systematic treatment of a difficult subject and for its lucid phraseology

LES HYDROAEROPLANES Par Pierre Rivière, ingénieur Préface de A Tellier Un vol, illustré Paris Librairie Aéronautique, 40 rue de Seine Price, 3 francs.

M Rivière has given us a very instructive book on the development of the hydro-aeroplane from the first experiments of Fabre and Curtiss to the present day He has also critically analysed the conditions that must be met by a successful hydro-aeroplane and shows why the early types of Fabre and Curtiss were defective Indeed the system of supporting the wings by floats carried near the outer ends of the wings and combining the floats with wheels, so that the machine may run on land as well as on water must eventually be abandoned The real hydro-aeroplane is the flying boat type the credit for having devised which must be accorded to Curtiss, although our author is inclined to think otherwise. Rivière's book may be heartily recommended as a useful discussion of an important phase in the development of the flying machine

HANDBUCH NEUZEITLICHER WOHNUNGSKULTUR Band Herrenzimmer Darmstadt, 1912 Alexander Koch

A remarkable change has come over the spirit of German art and architecture within the last twenty years Instead of blindly following the French example Germans have deliberately struck out for themselves in the effort to evolve a really national art Naturally in this effort to achieve artistic independence much was created that was riotously extravagant and even outrageous But the analytical German mind and the wholesome influence of the soberer critics exercised a tempering influence Nowhere is this German ambition to become artistically independent more apparent than in domestic architecture. A type of dwelling has been created which is distinctive in character Alexander Koch's periodicals *Innen Dekoration* and *Deutsche Kunst und Dekoration* have done yeoman work in popularizing the best of the new ideas. If we may judge from the volume which lies before us and which is devoted to *Herrenzimmer* (studies libraries and the like) it is Mr Koch's intention to collect in book form the better examples of the German architect's and interior decorator's efforts at home beautifying The volumes are beautifully printed and splendidly illustrated To American architects they ought to be most welcome for their suggestiveness. While a certain stiffedness is apparent in much of the furniture and decorations illustrated there can be no question that, with some modifications, the designs presented are of permanent value. It is a far cry from the *Spiessbürger* or intensely bourgeois idea of home furnishing to these highly artistic and comfortable arrangements.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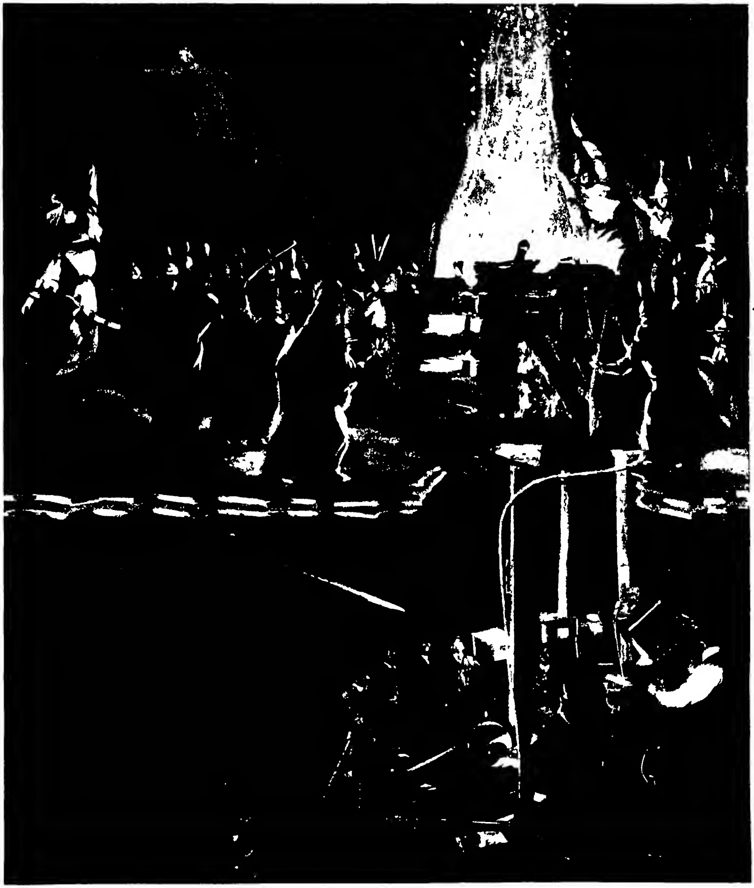

Sixteen men and elaborate devices are required to produce the effect.—[See page 373.]

A FIRELESS FIRE ON THE STAGE

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are sharp, the articles short and the facts *authentic* the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply and interestingly the world's progress in scientific knowledge and industrial achievement

Foreign Dreadnought Developments

WITH the exception of the United States, France is the only naval power of any standing which announces the characteristics of her new warships in advance of their completion In the majority of cases however, the details leak out by some means or another, and in only a very few instances are the main features of large ships now under construction unknown

The most striking point in recent dreadnought development is the increasing size and power of the gun. The British navy was the first to abandon the 12 inch gun as the main armament of dreadnoughts, and four battleships are now in commission—"Orion" "Thunderer" 'Conqueror,' and 'Monarch'—which have ten of these weapons, firing 1 250-pound projectiles in five center line turrets The same caliber of gun is mounted in the four ships of the 'King George V" class, and the four of the Iron Duke class, now completing but the gun is of a much more powerful type The length of the shell has been increased and 200 pounds added to its weight much of the addition being accounted for by an increased weight of bursting charge Another notable development in British dreadnought designs is the restitution of the 6-inch gun

In view of the interest taken in America in the subject of the battle-cruiser, it is important to note that this type is now being 'abandoned' in England That, at any rate is the way in which the latest development of the capital ship is generally described, but it would be equally true to say that the battleship is being abandoned and that in the future only battle-cruisers will be built The essential difference between the two types is that the battleship has thicker armor, more guns and less speed than the battle-cruiser Thus, to take two contemporary ships, the battleship Iron Duke has a 12 inch belt, carries ten 13.5-inch guns, and is designed for 22.5 knots, while the 'Tiger' battle-cruiser, has a 9¾ inch belt carries eight 13.5-inch guns, and is designed for 28 knots. The first four battle-cruisers built for the British navy were designed for 25 knots, and the 'Iron Duke class are the first battleships to be designed for more than 21

Last year four large armored ships were included in the British programme—Queen Elizabeth' Barham Valiant ' and Warspite and these will represent the amalgamation of the two types. Their designed speed is 25 knots, which if past experience goes for anything will mean a trial speed of 27 knots They are to carry only eight big guns, but these will be of 15 inch caliber firing 1 950-pound projectiles the total broadside will be 15,600 pounds and their main belts will it is believed, be 15 inches thick It will be seen, therefore that they will have the characteristic battle-cruiser armament of eight big guns, as well as a very high speed while the only battleship feature remaining to them will be the thick armor belt It is noteworthy that in these ships the disposition of the Michigan guns will be reproduced.

The German authorities have not been very happy with their dreadnought designs. The first eight battleships built have twelve big guns each (11 inch in the first and 12 inch in the second four) but only eight in either case are available for broadside fire. In the Kaiser and Friedrich der Grosse" recently completed the number of 12 inch is reduced to ten, but there is a considerable gain in efficiency inasmuch as all can fire on either beam though only over a small arc, as two of the turrets are placed *en echelon* The next group those of the Kaiserin class have twelve 12-inch and although it is understood that there is a full broadside the arrangement of the turrets is not known. It was not until the 1st of March last that the first German ship carrying a heavier gun than the 12-inch was launched. This was the 'König,' a 27,000-ton ship, which will have ten Krupp 14-inch guns, firing 1,387-pound shells in five center line turrets, the total broadside being 13,870 pounds.

From the point of view of design, the most interesting foreign dreadnoughts now projected are undoubtedly the French battleships 'Normandie," "Gascogne," 'Flandre," and 'Languedoc," which are to be laid down this year These ships will be 574 feet long and 88.5 feet in beam with a displacement of 25 200 tons, a designed speed of 21 knots, and a maximum thickness of 12 6 inches of side armor Their main armament will comprise twelve 13.4 inch guns, representing a total broadside of 15,984 pounds, and these will be mounted in three quadruple turrets on the center line, there being four guns abreast in each turret. There will also be twenty four 5.5-inch guns and six submerged torpedo tubes. The three-gun turret is now a well-established feature in many navies—it has been adopted by the United States, Italy Austria and Russia, but the interesting experiment about to be made by the French authorities will be watched with interest

The Brazilian battleship 'Rio de Janeiro, now completing at Armstrong's works at Newcastle, makes a striking contrast to these French vessels. Originally intended to carry twelve 14-inch guns on a tonnage of 32 000, the 'Rio de Janeiro" was redesigned at the desire of the Brazilian authorities after she had been some months in hand, and is now to carry fourteen 12 inch on a displacement of 27,500 tons, the total broadside being 14,000 pounds. The guns will be distributed over seven turrets, all mounted on the middle line—two forward (one superposed), two amidships between the funnels, and three aft (the center one superposed) The length of the ship is 670 feet over all and the designed speed 22 knots, but the main armor belt is only 9 inches thick. The anti-torpedo battery consists of twenty 6-inch guns.

Italy has always been noted for originality in war ship design. The 'Dante Alighieri" carrying twelve 12 inch on 19 400 tons, was the first triple-turreted warship to be completed and that nation has now in various stages of construction five ships which are to carry thirteen 12 inch Ten of these are arranged in the same manner as the 14 inch of the 'Nevada' and Oklahoma and there is an additional three-gun turret amidships. The American arrangement referred to is reproduced exactly in the Morosini" and Dandolo, laid down in December, but the Italian vessels will differ in having less armor, a designed speed of 25 knots, and a displacement of 28 000 tons A striking advance is to be made in the case of two ships to be laid down this year For these vessels the Admiralty had under consideration two designs, one showing a ship of 28,000 tons carrying nine 15-inch in three turrets, and the other a vessel of 35 000 tons carrying twelve guns of this caliber in four turrets, 25 knots being the speed in each case. The latter design is stated to have been decided upon Given another 800 tons these ships would be exactly twice as heavy as the 'Dreadnought" of 1906. The Italians favor big ships, and their latest, if they be built, will surpass anything building or afloat, their total broadside of 23,400 pounds exceeding even that of our own "Pennsylvania," which is 16,800 pounds. She can scarcely equal the "Pennsylvania" in protection, since a large part of her big displacement must be allotted to the powerful motive power necessary to drive her at 25 knots.

Life Without Heat

AT a time when the sad fatality that has befallen the British Antarctic expedition brings home to our minds in a dramatic fashion the deadly dangers which menace those who brave the terrible cold of the regions of eternal snow and ice an additional interest invests the article of an eminent French savant who discourses to us on the beneficial effects of cold In a recent number of the *Revue des Deux Mondes* Prof Nordmann discusses the effects of temperatures where the cold of the polar regions would seem like the overmastering heat of an intense tropical summer—temperatures which closely approach the ultimate zero of temperature, the awful and unimaginable cold of ultra-stellar space Prof. Nordmann points out that human beings (even the French) are a cold-blooded race, that very little heat would kill us, whereas there is reason to believe that we can stand any amount of cold. Judged from the standard of temperature set by the Universe, where stars reach a temperature of 40,000 deg Cent, it is seen that we live on a very cold planet—we are not really much removed from the absolute zero of temperature. But although a rise of a few degrees would destroy not only all human beings, but every form of life on this planet, experiments have been conducted which show that life can successfully resist the extremest cold.

Living organisms, various bacteria and spores, have been plunged in liquid air, i. e., have been reduced to a temperature of —190 deg. Cent, without apparently harming their vital functions. They have been subjected to the incredible temperature of liquid hydrogen —252 deg Cent, and even liquid helium, which is very near the absolute zero, and kept at that temperature for months. Yet on being again restored to their normal temperature they have manifested their vital activities unimpaired. At the absolute zero of temperature these organisms simply seem to go to sleep, and to continue life refreshed when they are restored to their usual surroundings. These facts have found application in the storing of vaccines, which are usually useless forty days after they are prepared But by subjecting them to extreme cold, they may be kept for an indefinite length of time, and when required for use they manifest their properties unimpaired.

Incidentally, these experiments remove the objection, based on the cold of intra-stellar space, to the theory that life may be transported from one planet to another We now know that living organisms can survive the extremest cold Prof Pictet has made similar experiments on much more highly organized creatures, such as fishes, and has obtained similar results, a fact which leads Prof. Nordmann to suggest playfully that the process may one day be applied to man himself In that case a way of escaping our troubles when they became too much for us, would be to enter the Government refrigerator leaving instruction that we are to be awakened in say, 200 years' time However this may be, it is certain that these experiments will lead to many applications of importance, and that they are of much interest for many scientific theories.

Among the many industrial applications which have attended the artificial production of great cold, is the ready means it affords of obtaining large quantities of pure oxygen and pure nitrogen Air consists chiefly of a mixture of these two gases, and the fact that they liquefy at somewhat different temperatures has been utilized to obtain them from the air, a method which is analogous to the well known one of fractional distillation so valuable to the chemist

Oxygen liquefies at a temperature of —182.5 deg Cent, and nitrogen at —193.5 deg Cent This slight difference of eleven degrees has proved sufficient to effect the almost complete separation of these two gases. The pure oxygen so prepared has many important uses, but one of the most novel has been discovered under the auspices of the ministry of war in France It is found that powdered aluminium in liquid oxygen forms a high explosive, having about twice the explosive force of ordinary gunpowder while another explosive formed of carbon in liquid oxygen is of about the same strength as dynamite This is obviously a discovery which may have important developments.

The purity of the nitrogen obtained by liquefying air has been utilized in the formation of cyanides, which are of such importance in present day agriculture. The other constituents of the air, argon, crypton, neon xenon and metargon, are also obtainable by this fractional liquefaction process. Neon, which is so rare that in 65,000 parts of air only one part is neon, may be obtained in quite appreciable quantities in this way It is well known that when an electric discharge is passed through a tube of neon, the tube emits a beautiful rosy glow The discharge takes place very easily, a difference of potential of thirteen volts between the electrodes being sufficient, as against 1,000 volts as is required for air But in the ordinary way the beautiful reddish glow soon fades, owing to the fact that impurities from the electrodes become mingled with the gas. A way of overcoming this has been found One of the most remarkable phenomena which has transpired in studying the behavior of substances at low temperatures is the extraordinary absorption powers manifested by carbon at the temperature of liquid air It will absorb gases so readily that it is one of the chief agents now used in the production of high vacua The impurities in a neon tube are absorbed by carbon surrounded by liquid air, and this method has proved so satisfactory that it has been found practicable to utilize neon tubes as cheap illuminants in Paris. Here again is an application whose developments may prove of considerable importance The importance of cold in preserving provisions is well recognized in America, and however much we may feel inclined to grumble at the winter, we must agree with Prof. Nordmann that cold, as much as heat, is a beneficent friend of mankind.

Removable Taxicab Upholstery.—Setting an excellent example in sanitary construction, one of the large Chicago taxicab companies has just taken delivery of a number of new vehicles in which the upholstery is removable for cleaning purposes. Instead of being attached permanently to the backs and seats of the bodies, the upholstery is attached to boards which in turn are keyed to the body Thus it is a simple matter to remove the cushions and clean them, the operation also leaving the interior of the cab unusually accessible.

Electricity

Antenna Strung from a Cliff.—According to a newspaper report, an Italian engineer, named Galetti, is building a wireless station under a high cliff in the village of Lescheaux, near Chambery, Southeast France, with which he hopes to communicate with New York. In place of the usual vertical aerial, he has set up at the top of the cliff two posts each about 25 feet high, between which a wire is stretched. To the wire a series of other wires nearly three thousand feet long are connected and conducted to the instruments in the shack at the foot of the cliff

Electric Vehicle Promotion in New York City—An appropriation of $30,000 has been made by the New York Edison Company toward the establishment of an electric-car garage in New York city This will be expended at the rate of $10,000 per year under the auspices of the New York office of the Electric Vehicle Association of America, so that there shall be no question of partiality shown toward cars of any particular manufacture In connection with the garage there will be an active educational campaign conducted among customers and prospective purchasers of electric cars.

Fire Produced by Electric Hand Lamps.—Recently there was a fire in a theater in the city of Stettin, Germany, which was attributed to an ordinary electric hand lamp of the type provided with a wire guard The matter was investigated and it was found that the ordinary hand lamp if provided with a 16 candle-power, 220-volt carbon filament lamp could cause a fire if brought into contact with sawdust or other equally inflammable material in such manner that there is little circulation of air to carry off the heat. But no fires resulted from tests with metal filament lamps of equal rating, although in lamps of 25 or more candle-power ignition could be obtained

Sterilizing Swimming Pools.—For the past three years the public baths in the borough of Poplar, London, have been treated with a so-called "electrolytic fluid" which is an oxidizing fluid obtained by the electrolysis of magnesium chloride. A committee appointed by the Royal Sanitary Institute recently investigated the use of this electrolytic fluid and reported very favorably upon it. They found then that when enough of the fluid was added to the water to supply one part of free chlorine for every one or two million parts of water, the pool was kept pure and free from odor and there was no tendency for the water to deposit slimy sediments on the floor This treatment made is unnecessary to renew the water oftener than once in a week or ten days.

The Electrical Auctioneer—Auction sales are accompanied by a great deal of noise, and in order to do away with this an electrical method has appeared in Holland which seems quite promising, and the sales are now carried on almost in silence It is now applied to selling eggs by auction, according to the custom which prevails in the agricultural centers throughout the country in the weekly markets. Eggs are auctioned off in 2,500 lots, and on the new plan each bidder has a numbered seat with a push button and wiring The seller is stationed in front of a large dial having prices ranged around it from lowest to highest. There is also a large board containing like numbers which can be electrically lighted, and these are connected to the seats. After the proper announcement of the lot of eggs as to quality and weight, the seller starts the hand slowly moving around the dial When at any figure, the buyer presses his button and the corresponding figure on the board lights up, and his number is registered by an annunciator As the hand moves on, the next bidder can register a higher number, and so on until the bidding is finished The method is said to work very well, and no doubt can be applied to all kinds of auction sales

Long-distance Wireless Telephony.—The Paris daily papers state that wireless telephone messages were lately sent over a distance of more than 600 miles from Rome to Tripoli. Wireless telephony does not appear to have made any marked progress until the present time, since the well-known work of Poulsen and Prof Majorana's experiments in Italy This latter inventor used a sensitive microphone of his own design and in this way the torpedo destroyer "Lanciere" covered 250 miles in the region of Sicily However, the recent results obtained by Prof. Vanni of the Military Wireless Institution, near Rome, are quite remarkable, as he is able to connect with a point in Tripoli, or about 600 miles from Rome. In these experiments he makes use of a liquid microphone based upon the ideas of Chichester Bell, brother of the celebrated Graham Bell. Using a microphone of this kind together with apparatus of the Marconi type the voice could be very well heard at Tripoli, and the [illegible] still more [illegible] to deliver [illegible] have [illegible] African [illegible] hopes [illegible] Although the [illegible] such [illegible] diffi- [illegible]

Science

The Falkland Islands, in the South Atlantic Ocean, are a British colony with a population of over 3,000, possessing a comparatively imposing array of officials—governor, executive and legislative councils, colonial secretary, etc. They have also a bishop and a cathedral. This interesting pocket edition of a colony has hitherto had no telegraphic communication with the world, and only a monthly mail to England Its isolation is now at an end, a wireless telegraph station has been opened at the capital and metropolis, Port Stanley (population 880) Communication with the outside world will be had only through the wireless station at Montevideo, Uruguay, 1,240 miles distant.

A Fixed Date for Easter—This long-mooted question is discussed anew by Camille Flammarion in *L'Astronomie* It is doubtless regrettable that an epoch in the calendar which fixes the dates of so many other events, civil as well as ecclesiastical, should be subject to such extraordinary variations in its time of occurrence The extreme range is over a month (March 22nd to April 25th) The French astronomer points out that since for religious reasons Easter must be celebrated on a Sunday, in order that it should fall on the same date every year it would be necessary to reform the calendar as a whole—a step that he considers desirable for other reasons Pending this consummation, however, he suggests that the range in the date of Easter might be reduced to a week, viz., from April 5th to April 11th

Relative Land and Water Areas of the World—In our school days we learned that water covers three fourths of the earth's surface, and land the other fourth This statement dates back to a time when very little was known about the distribution of land and water in the polar regions, and needs to be considerably revised in the light of recent discoveries. Taking account of the results of the latest polar expeditions, Prof Wagner estimates that the ratio between land and water is 1 2 42, in other words, that about three sevenths of the earth's surface is land, and the rest water This estimate assumes that only 10 per cent of the surface north of latitude 80 degrees north is land, an assumption that may be considerably modified by the forthcoming explorations of the great unknown region north of British America and eastern Siberia

Natural History Explorations in Borneo.—For more than ten years past Dr W L Abbott, of Philadelphia has been exploring the Malay Archipelago, and presenting all his collections in natural history and ethnology to the Smithsonian Institution The latest annual report of the Institution announces that although Dr Abbott has been obliged, through illness to abandon personal participation in this admirable undertaking, he has engaged the services of a collector and provided funds for continuing the explorations he had begun in Borneo The field work will be carried on in eastern Dutch Borneo, the natural history of which is practically unknown, and from which there are at present no collections in American museums. A rich harvest is expected

An Investigation of Aneroid Barometers has been in progress for the past two years at the U S Bureau of Standards, in Washington, and will undoubtedly lead to improvements in the construction of these indispensable instruments. Intercomparisons have been made of a large collection of instruments, from twelve makers These have been subjected to mechanical, temperature, free-air, and air-pump tests. In the last named the barometer is held at the lowest pressure for 24 hours, in order to observe what is known as the "creep" This is a defect in the action of an aneroid when subjected to a large and rapid change of pressure, consisting of a sluggish adjustment of the index to or toward the correct reading Its determination appears to be the crucial point in ascertaining the quality of an aneroid One result of these investigations is the development of new standard specifications for the purchase of aneroids by the Government.

Capt. Amundsen has received a grant of $20,000 from the National Geographic Society toward his coming north polar expedition. In voting this grant, the research committee of the society desired especially to increase the scientific possibilities of the undertaking, as to oceanographic research, meteorological and magnetic observations, etc. Amundsen expects to start North from the Pacific coast some time in the summer of 1914 His ship, the "Fram," which now lies at Buenos Aires, will be sent through the Panama Canal some time this summer or autumn, and it is understood that the authorities have arranged that she shall be the first vessel, other than a man-of-war, to pass through the big cut. The personnel of the coming expedition will be practically the same as that which made the recent journey to the Antarctic. After passing through Bering Strait, it is hoped that the ship will drift right across the polar basin, following the supposed route of the Melville-Bryant casks and the wreckage of the "Jeannette" In this case, the party should pass not far from the pole, and emerge from the unknown somewhere between Greenland and Spitzbergen.

Automobile

Shorter French Salon Scheduled—At the last meeting of the French Chambre Syndicale de l'Automobile, it was resolved that the duration of the next French Salon be restricted to 10 days, the last one was open 16 days. Waning attendance during the last days and the impatience of manufacturers to return to work, are understood to have prompted the resolution

Air Filters for Carbureters.—Despite the fact that it has been proven that much of the so-called carbon deposit that collects in cylinders is due to dust drawn in through the carbureter, the maligning of oil goes on Modern lubricants are notably free from carbon content To insure a proper test of a new oil it would be only fair first to fit a comparatively fine screen to the carbureter air intake It will be found that the screen must be cleaned of accumulations of dust occasionally

An Ingenious Oil-level Indicator Giving indication of appreciation of the thoughtlessness of motorists in general one prominent manufacturer has taken to equipping his cars with an oil-level indicator which short circuits the ignition current when the supply of lubricant drops below normal It is nothing more complicated than a tube inclosing a float buoyed up by the oil The float carries a contact which touches another contact when the float drops, thus short circuiting the magneto and giving unmistakable indication of the scarcity of oil

Electric "Cyclecars" for Berlin.—For some time authorities of the city of Berlin have been experimenting with a new type of light electrically propelled vehicle for the distribution of mail and a number of the cars have been purchased In appearance and construction they are not unlike the new type of small automobile styled "cyclecar" for the want of a better name, that has sprung into such prominence in England within the past year They are capable of transporting 500 pounds at a maximum speed of 18 miles an hour the battery being of sufficient capacity to permit a working radius of approximately 40 miles on a charge

Worm Drive and "Valveless" Engines Abroad—Although development of the worm drive is practically at a standstill in England, where it first made its appearance, it is only just being taken up with seriousness by French builders, who in other matters generally have taken to such innovations with avidity and almost without the thorough investigation which invariably precedes British adoption of any new construction The so-called "valveless" engine—Knight types and others—which also first made its appearance in England, on the other hand, is very much more in vogue on the Continent than it is across the Channel

Why Not Papier-maché Bodies?—Now that *papier-maché* is used so extensively in other industries there would seem to be opportunity for employing it with profit in the manufacture of automobile bodies The framework of the body for instance might be built up of netting and light steel braces with the *papier-maché* firmly pressed into the interstices of the netting Such a body would be lighter than a steel body, less expensive to build than an aluminium one, and strong enough Incidentally, *papier-maché* is capable of being highly finished and it is quite probable that enamel would show less tendency to chip or flake off it than when metal is used

Revenue from Battery Charging With the increasing use of electric vehicles for both pleasure and commercial purposes central stations are paying more attention to battery charging as a prime source of revenue rather than a secondary one, and the wisdom of the practice is revealed by the fact that one electric light company last year earned $150,000 net from this source alone The previous practice of viewing battery charging as an excellent "side line" to assist in reducing overhead expenses, rapidly is giving way to the more logical view that it may with profit be made a specialty in charge of qualified experts ready and willing throughout the twenty-four hours instead of during only that time when the central station meters do not indicate the peak load

Gasoline Up in England—Echoing recent American advances in the price of gasoline, the British Shell interests, which supply the bulk of the fuel used in England, have announced an advance of approximately 4 cents a gallon in the price of their standard grades, Shell I and Crown, which formerly sold for 39 and 37 cents a gallon, respectively The new prices are 43 cents a gallon for Shell I and 39 cents for Crown What is even more important, as indicating a measure to stimulate a demand for the heavier fuels, is the announcement of a new grade of fuel known as Shell II which is priced at 39 cents a gallon. The specific gravity of the new fuel is given as 0.728 to 0.735, as against 0.715 to 0.720 for Shell I and 0.745 to 0.760 for Crown The Anglo-American Oil Company, which supplies fuel known as Pratt's spirit, also has increased its prices, bringing them on a par with those of the Shell products Incidentally, it is interesting to note that the present price of gasoline in South Africa is 75 cents a gallon, and this is said seriously to affect the trade in large cars.

End Dump Bodies for Commercial Vehicles

By Ross Babcock, M. E.

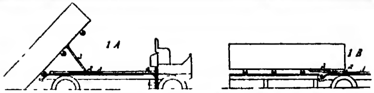
AS divided as are opinions on the operative cost of commercial vehicles engineers are of one mind that truck efficiency demands the reduction of idle time to the minimum. The attainment of maximum efficiency with any piece of machinery requires its operation at as near to full capacity as is possible and the elimination of work or movement that is not strictly useful and the motor truck is no exception to the general rule. It costs very nearly as much to operate a truck light as it does to operate it loaded, and where it is not possible with the aid of removable bodies for instance, to reduce the ratio of time spent in idle running to time spent in performing useful work, other means must be adopted. Otherwise it is altogether likely that the yearly balance will be on the wrong side of the owner's books.

Until comparatively recently little heed of specialized body designs has been taken by commercial vehicle builders, though within the past twelvemonth this feature has come in for its just measure of attention. One reason for the noteworthy change of front on the part of manufacturers very likely is due to a general awakening to the fact that if outputs are to be disposed of, the maker must not only help the purchaser by showing him how to use existing designs with profit to himself but in addition he must suggest new uses for his products or adapt them to uses heretofore served only by horse-drawn vehicles.

In this respect, it is interesting to note that the end dumping body either manually or mechanically operated slowly but surely is assuming the place of importance it undoubtedly deserves. There are abundant reasons why this should be so. Given sand or coal or broken stone to handle for instance acute sight is not needed to make plain that antiquated unloading methods—shovels and the muscular power of a "gang"—scarcely are compatible with the modernness expressed by the vehicle itself. Such methods necessitate that virtually all the time saved by the motor truck in making the haul quickly be sacrificed in unloading. Hence it is entirely logical that some means of making up the deficiency be sought for and the dumping body truck represents that means. Already there are a score or more of makers who specialize in the construction of such apparatus, and if the present tendency can be taken as a criterion the ranks of those manufacturers without doubt will be materially swelled in the not far distant future.

There are four general types of dumping bodies, and they are nearly all of the upending variety. Side dumping bodies are not much used, probably because it is so much easier to maneuver a motor truck than it is to maneuver a horse-drawn one. Seldom is space so restricted that it is impossible to back the truck into position.

In designing these dumping bodies, the tremendous power of the screw is understood and has been very liberally made use of. Hence the screw-operated mechanism forms one group by itself. The other three groups may be broadly classified into (2) those that employ some sort of rack and pinion mechanism, (3) those that are chain hoisted, and (4) those that are hydraulically operated.

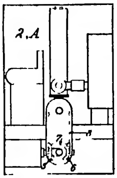


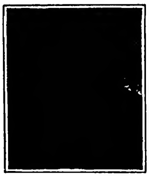
Figs. 1, 1A and 1B.—Motor truck with dumping and "demountable" body

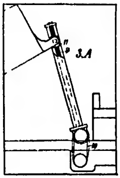
In the first group, the vehicle shown in Fig. 1, and diagrammatically in Figs. 1A and 1B, is interesting, for it not only provides a means of dumping the body with the power of the engine, but the body is "demountable" as well. For operation, it depends upon a longitudinal screw *1* driven through a pair of gears *4* by the engine. A nut *2* on the screw is hinged to an arm *3* which is permanently attached to the body. The body is mounted on rollers. As it is forced backward by the screw, the first pair of rollers drops into the curved end of the track on the chassis, thus forming a bearing on which the body tilts. When the body is to be dismounted, the truck is backed up to a platform of the proper height and then, instead of dropping into the curved ends of the track, the first pair of rollers passes upon the platform and the body continues straight back until it is clear of the chassis, when the arm *3* is uncoupled from the screw at the nut *2*. To return the body to its normal position, the direction of rotation of the screw is reversed by an idler pinion which is brought into action by means of a lever conveniently placed at the driver's right hand.

Fig. 2.—Dumping body elevated by a double telescoping screw

In Figs. 2, 2A and 2B an altogether different and more popular arrangement of the screw and nut principle is depicted. In this case the screw is vertically mounted on a swiveling joint and driven from bevel gears and chain from the propeller shaft. The screw itself is virtually a double screw, or one screw telescoping into another. Thus, when the body is down, the height of the screw is only slightly greater than the height of the body. The double screw is operated from a pair of bevel wheels *5* and *6*, mounted on a shaft and arranged so that either may be clutched by means of a lever at the driver's seat. Engagement of the bevel *5* therefore causes the sprocket wheel *7* to turn in one direction, the movement being transmitted to the screw through the intermediary of a chain *8* and another pair of bevels, and thus to hoist the body. Engaging the other bevel *6* causes the chain to run in the opposite direction, thus bringing the body down again. The shaft on which the bevels *5* and *6* are mounted is driven from the propeller shaft through another pair of bevel gears. In operation, the inner screw first rotates within the outer one, raising the body half way, when a stop causes the outer screw to rotate within its casing, raising the body the rest of the way.





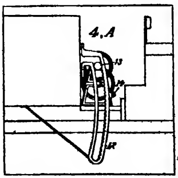


Figs. 2A and 2B.—Telescoping screw details. Fig. 3A.—Plain screw elevator

The arrangement shown in Figs. 3 and 3A is considerably simpler, though it has the disadvantage that when the body is lowered the screw projects above the body quite a distance. It is thoroughly protected, however, and there can be little objection to it unless the vehicle is to be used where the head room is very restricted. In this case the elevating screw *9* is driven by a short inclosed chain *10* from a transverse shaft which is driven by a pair of inclosed bevels on the clutch shaft. Engaging either bevel serves to rotate the screw in either direction, thus causing the

(Concluded on page 382.)

Fig. 3.—Dumping body elevated by a power-driven plain screw.



Figs. 4 and 4A.—One of the simplest types, a hand-operated pinion and curved rack.

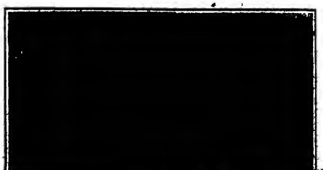


Fig. 5.—Plain rack and pinion and chain for dumping the body back

END DUMP BODIES FOR COMMERCIAL VEHICLES

Raising up the moon, 3,650 candle-power is required for a full moon.

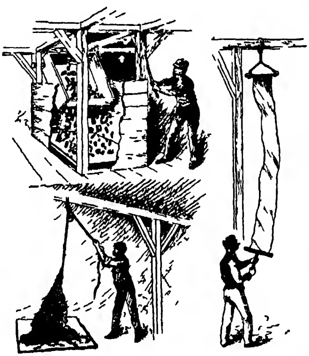
Sciopticons for projecting stars.

The Elements on the Stage

Thunder, Lightning, Wind, Rain and Fire

THE production of thunder lightning wind rain and fire as well as astronomical phenomena has long attracted attention of theatrical engineers and electricians We have been enabled through the courtesy of the officials of the Century Theater, formerly the New Theater in New York city to present to our readers a unique series of pictures which are of great interest In passing it may be stated that the stage of the Century Theater is a most remarkable one and is especially adapted for spectacular productions and we hope at a later date to present an article on the stage proper One of the unique features of it is the great turn table driven by an electric motor thus permitting one scene to be set while the audience is viewing another scene The revolving stage is not needed in plays where drop scenes and cloths are used exclusively The turn table was used in the fire scene in The Daughter of Heaven" a drama of modern China by Pierre Loti and Judith Gautier which succeeded The Garden of Allah at the Century Theater The big Algerian play with its marvelous scenery and its wonderful sand storm was even exceeded in beauty by the gorgeous setting of the Chinese play The scenery properties costumes and effects were a revelation of refined Oriental taste

We need not concern ourselves with the play proper except for the fire scene, which occurs in the second part of the play The Manchu advance has swept everything before it Of all the Ming strongholds the palace citadel alone holds out Gaping breaches have been torn in its walls by the



The three stages of thunder

enemy's artillery but the soldiers of the Empress go on fighting with unfailing courage The Empress is anxious to die with her faithful followers but is dissuaded from doing so by the hope that if she is able to escape by the secret passage through the tombs of her ancestors she may yet live to see the sovereignty of her son established Before she goes at the request of her soldiers she lights the great funeral pyre she has built in order that they may meet death at their own hands rather than fall into those of the enemy The fire becomes brighter and brighter while the defeated warriors throw themselves on the blazing logs The fire streams up and is lost behind the top of the proscenium arch The manner in which this effect is produced is very interesting involving as it does an interlocking series of effects which result in a most realistic effect without real fire

The funeral pyre measures 8 by 10 feet and is 6½ feet high It is dragged on a truck to the back of the turn table before the curtain is scheduled to rise on the Walls of Nankin scene It is located over a trap so that when the turn table is revolved the pyre is brought directly over an opening in the lower portion of the stage flooring The pyre is made of an iron frame covered with wire netting and covered with asbestos cement The opening in the floor of the stage serves to carry the hose for the smoke and steam and for the artificial light used in carrying out the idea The funeral pyre is also covered with silken materials, such as artificial feathers In addition to these fringes there are two or more fans which are so

Thunder drum for rain and reverberating thunder, lightning flasher and wind machine.

Incantation scene. Air is forced through acid, ammonia and perfumed glycerine.

placed that the light projected upwardly through the opening falls upon them. These mats are mounted on movable boards and are designed to be raised within the structure by ropes which are pulled up slowly by men at the back of the pyre. By having the mats adjustable vertically, it is possible to represent the fire starting and increasing in volume until the flames apparently arise to a considerable height above the structure and such increase in height and size may be made by jerky strokes on the handle so as to cause the flame to apparently rise to its height at intervals.

The smoke and the wind necessary to assist in the production of the illusion are generated in the cellar below as shown in our engraving. Two men are concealed in the pyre and with flexible canvas pipes they diffuse the smoke and set the silken material in commotion so as to give the swirling effect of flame. This wind is derived from a blower driven by electricity. When the Empress applies the torch the flames rise and are lighted one at a time with arc lamps, giving the effect of the fire riding higher and higher. The electric spot lights are unblinded when the blower is started. A powerful search light is used for lighting up the big flame. The smoke is generated in four metal smoke boxes containing forty-eight one-minute smoke pots, which are lighted by tapers and kept damp with water which is squirted during the progress of the effect through small iron doors in the smoke boxes. As this smoke passes upward through the pipes, it passes through four wire gauzes which positively prevent any sparks being scattered around the stage. At the back of the pyre is a steam jet arranged so that the steam rises at the back of the pyre, carrying the reflection of the light from the search light to the flies, giving it the appearance of a very high flame. Electric fans are also used underneath the stage out of the path of the beams of light projected from the several electric lamps. The effect of sparks is given by confetti, which is thrown into the blower and is projected upward by means of the canvas pipes. The effect is so realistic that the fire can continue, if desired, with all the stage lights on. It requires sixteen men to work this illusion. The manipulation of the spot lights and the search light is very clever, and the effect from the audience is that of a true conflagration. The men inside of the pyre are dressed in asbestos clothing. Some idea of the cost of production of an effect which only lasts for a very short time may be gained when it is stated that $4 worth of smoke pots are used every performance.

The production of wind effect, thunder and lightning are usually worked practically simultaneously, and three of these devices are shown in one of our engravings. The wind machine can be constructed by any carpenter. It consists of a drum with slats which are rotated over an apron of corded silk, which produces the peculiar whistling sound of wind. Usually two wind machines are used—one on each side in the side scenes or behind the back drop.

The lightning device is shown in the center of the engraving. A metal hood provided with a wire gauze screen to prevent fire serves to hold five cups of powdered magnesium. A fuse is placed in each cup which is connected independently to a portable switch box so that one of the electricians can turn on the current exploding one or more of the charges, so as to give the required effect.

Thunder is produced in two parts of the stage. The crash takes place in one of the fly galleries while the reverberation or roll is produced on the thunder drum, which is beaten by hand near the back drop. The cue is given to the fly man by means of an electric light. When he receives the signal he releases a bolt which allows a pivoted box to dump about 800 pounds of stone and assorted junk down a chute, striking a large iron plate at the bottom. This is immediately followed by 300 pounds of chain, which are also released and fall on an iron plate. Then the roll is begun by dropping five or six cannon balls down a chute which is tortuously inclined and is technically known as a "rabbit hutch." The *finale* of the effect is produced by deforming a large sheet of sheet iron which is twisted. This is used in connection with the thunder drum. The simultaneous production of wind storm, lightning and thunder calls for simultaneous signals which must be obeyed in the shortest space of time.

Another play at the Century Theater which has had a considerable run is "Joseph and His Brethren," a pageant play in four acts, based on the biblical narrative. Several of the scenes are of great beauty, particularly that which takes place at the Pyramids in the fourth act, where the moon and star effect is most beautiful. Both of these effects as well as the fire scene were invented by the electrician of the theater, Mr. Benjamin Bierwald. The moon is a large basin-like affair, which is capable of being raised and lowered with a small winch. The linen disk is painted as we see in astronomical photographs. Behind the disk are incandescent lamps totaling 3,650 candle-power. As the moon rises the lights are put on resistance and just show a glow as the disk is raised. The resistance is then lessened and the lamps become fully incandescent. A board in front protects the linen disk when it is lowered. The time required to raise the moon is seven minutes for fifteen inches of vertical travel. The effect of the moon rising above one of the pyramids is most realistic.

The stars are produced by projecting lanterns on scioptica. In "The Garden of Allah" there were twenty-one of these projecting lanterns in use in different parts of the house. In "Joseph and His Brethren" eight lanterns are used. For very brilliant stars long focus lenses are used six feet from the drop. The stars are made by punching holes in a blackened brass plate and are projected on a curved cyclorama, which is let down while the scene is being set. The lanterns are covered with an asbestos cloth to prevent light leakage.

One other effect which is illustrated remains to be described. The incantation scene which occurs in the second act of "Joseph and His Brethren" is very interesting. In the room of Zuleika is a statue of Astarte, goddess of magic. In order to show how the effect is produced the statue of the goddess, known vulgarly on the stage as the "cook," has been temporarily removed to the proximity of the back drop, which is cut away so as to show the method of manipulating the smoke. Zuleika brews a love philter in a caldron before the goddess Astarte. Smoke arises from the bottom of the caldron, tinged with various colors. She pours the potation into a gold cup which is given to Joseph in the same scene. The trick is performed as follows: Compressed air is contained in an ordinary iron tank such as is used in lantern projecting. Air is driven through bottles containing hydrochloric acid and ammonia. The smoke is then washed and driven through perfumed glycerine, when it is ready to be liberated. A man kneeling down is working the dimmer, changing the light from red to green. The man by him is watching for cues to let the smoke rise, as the illusion would be promptly dissipated if the changing of the colors and manipulation of the volume of smoke were not perfect. Thus the smoke must cease instantly after her incantation has been finished.

Such in brief are a few of the interesting ways by which scenic effects are obtained to the delight and mystification of the onlookers. We are indebted both to Mr. Bierwald and Mr. W. W. Aulick for courtesies in connection with the preparation of the present article.

Misnamed Grains and Fruits

THE Chief of the Division of Horticulture in the Philippines, Mr. O. W. Barrett, has undertaken the heroic task of getting the inhabitants of those islands started right in the matter of popular plant nomenclature. As the Philippines are on the eve of becoming an English-speaking country he thinks it is opportune to apply the doctrine that an ounce of prevention is worth a pound of cure, and, before it is too late, he wishes to prevent the people of our new possessions from falling into certain anomalies of language that have become almost universal in the United States.

There is, of course, no more striking example of the way in which American speech has diverged from the parent tongue than in our use of the word "corn." In British countries there are several kinds of "corn," including wheat, rye, barley, oats, maize, rice and even leguminous plants, as peas and beans. Locally the word is often understood to mean the leading cereal crop of the district, hence while "corn" means wheat in most of England, it means oats in Scotland and Ireland. Our English ancestors found maize under cultivation by the Indians all over this country as their principal food crop, and gave it the not inappropriate name of "Indian corn." The name "mahis" (whence "maize") was current in Haiti, where the plant was first seen by Columbus.

The fact that the Spanish name for this plant, "maiz," is already familiar to the Filipinos would, no doubt, facilitate the adoption of the name "maize" in preference to "corn" among the islanders who learn English. Such is Mr. Barrett's hope, and he says, in writing on this subject in the *Philippine Agricultural Review*, "Let us adhere firmly to the old (pre-Columbian Arawak 'mahis') correct name by which this plant is known practically everywhere outside of the United States." However, there are certain difficulties in the way of carrying out this reform in a land where the natives are learning English from Americans, identical with those which would be encountered if the same thing were attempted in this country. Mr. Barrett does not appear to realize that the word "corn," as used by Americans, has so ramified in phrases and compounds of everyday use that to abandon it would entail an appalling number of other changes in our speech. Thus, to be consistent, we should have to substitute "maizemeal" for "cornmeal," "maizebread" for "cornbread," "maizestarch" for "cornstarch," and so on. No longer would Young America delight in the pink and the white varieties of "popcorn," but in "popmaize"! And how on earth should we ever persuade the newspaper paragrapher to indulge "Pyrmaize Comstocks" for so unconvincing a personage as "Popcorn [illegible]"? Let Mr. Barrett light his pipe ("maizecob," if he will have it so), and reflect upon the [illegible] consequences of his rash suggestion.

The rest of his propaganda is less revolutionary. For example, in urging the spelling "coconut" in lieu of the old-fashioned (but not oldest-fashioned) "cocoanut," he is merely seconding the recommendations of most American lexicographers. "Cocoa" for "coco," in this sense, arose from a stupid blunder in Doctor Johnson's dictionary, and has never had the sanction of careful writers.

A certain fruit which Mr. Barrett thinks should not be called "alligator pear" has become tolerably familiar in recent years to Americans who can afford exotic delicacies. Of course, it is not remotely related to the true pear, and some varieties are not even pear-shaped. In advocating the more euphonious name "avocado," Mr. Barrett says: "Objection to this word is gradually dying down, but, for some unknown reason, there still lingers in the minds of thousands of people an apparent preference for the hideous name 'alligator pear,' this is probably due, however, to the plebeian shrinking from any foreign-sounding word, especially if it has more than three syllables."

Another tropical product which has attained prominence in this country in comparatively recent times, and which has reached a greater perfection in Florida and California than anywhere else in the world, is probably best known to most of us as "grapefruit." This name is said to be due to its grape-like flavor (which few people can detect), or to the clustering habit of the growing fruit. It is sometimes called "shaddock," a name that properly belongs to a more primitive and much coarser variety of the same species. Mr. Barrett would have us abandon "grapefruit" in favor of "pomelo."

The "Sanatogen" Price Fixing Case

HEARING has recently been had before the United States Supreme Court in the case of Bauer & Co. and the Bauer Chemical Company against James O'Donnell, a Washington druggist. The plaintiff-appellants are manufacturers of "Sanatogen." The case comes before the court by certification from the Court of Appeals of the District of Columbia and the question involved is stated in the appellant's brief to be as follows:

"Can a retailer sell a patented article having a license notice thereon restricting the price at which the article can be sold to the consumer, such sale being made at a lower price than the license price, without such sale constituting an infringement of a patentee's rights when the article is made by the patentee, but is purchased by the retailer from a jobber?"

It is contended by the appellants that their patent grants them the right to exclude all others from any making, using or selling of the patented invention and relies on the decision in the Dick case, while the counsel for O'Donnell rely on the case of Bobbs-Merrill v. Straus and on distinctions they claim to exist between the Dick case and the present one.

The case is of immense importance, because for the first time the United States Supreme Court will have to pass upon the right of a patentee to fix the price on a patented article.

The Current Supplement

THE light of the sun streams down upon us year after year, a valuable source of energy for the most part going to waste. It is highly probable that the chemist is destined in the future to tap this stream for the benefit of mankind.—The Photo-chemistry of the Future is the subject of Prof. G. Ciamician before the International Congress of Applied Chemistry, published in this week's issue of our SUPPLEMENT.—Prof. W. Stempell tells us how the size of [illegible] structures in microscopic organisms may be estimated.—Christian Dantsizen gives an account of the research laboratory of one of our great firms of makers of electrical apparatus.—G. B. Cortelyou speaks on "Commercial and Financial Aspects of the Gas Industry."—The Paris Correspondent of the SCIENTIFIC AMERICAN describes a new method of studying [illegible] lines in air currents in the neighborhood of obstacles.—F. B. [illegible] describes some experiments on the conduction of electricity through an insulation.—The [illegible] of [illegible] fabrics, and the [illegible] which [illegible] are dealt with in an article [illegible] [illegible] Supplement of the [illegible]. A [illegible] writes on the [illegible] [illegible] richly illustrated article [illegible] [illegible] [illegible] [illegible]

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Wright Decision

To the Editor of the SCIENTIFIC AMERICAN

In reading the account in your journal of March 22nd of the decision in the Wright aeroplane case, I do not find that you refer to the Gottfried Schroder German patent, No 77,086, of October 4th, 1894. This Schroder patent involved a wedge-shaped balloon pointed at its front end and having a flat underside, and the balloon contained sufficient gas so that the whole airship with its contents would be supported by the gas. The airship was propelled forward by means of paddles operating like the screw propeller of a ship and driven by an engine. Transverse equilibrium is maintained by side wings pivoted and inclined simultaneously in opposite directions by crank and link connections, and an upright universal rudder is pivoted and connected with a steering handle in such manner that the rudder moved in exact correspondence with the handle when in any direction. This patent appears to show ailerons at opposite sides of the plane underface of the balloon in connection with an upright rudder. While you do not in your article, above referred to, mention this Schroder patent, it is discussed in an appendix to the brief of Mr H A. Toulmin solicitor and counsel for the complainant in the case of the Wright Company v Herring-Curtiss Company and Glenn H Curtiss, in which appendix it is said, referring to the German patent, "It is only for a balloon machine.

Judge Hand disposed of similar balloon proposals in the Paulhan case, saying 'these are all for lateral planes to dirigible balloons. The whole problem is so entirely different when suspension is effected by a reservoir containing a lighter gas than air, that there is not the least resemblance between the patents and the patent in suit.' " It is thought, however, that the Schroder patent will always be interesting in the history of aero navigation as an early instance of stabilizing device.

ONE INTERESTED

[While the Schroder patent undoubtedly does disclose equilibrating surfaces, which may be regarded as ailerons, it does not follow that the patentee was aware of the necessity of operating the vertical rudder simultaneously with the ailerons to prevent spinning of the entire machine. The Wright brothers were the first to insist on that principle, without it dynamic flight is impossible.—EDITOR.]

The Highest Type of Spring Wheel

To the Editor of the SCIENTIFIC AMERICAN

Referring to the letter of G F Fisher in your issue of March 22nd, it is evident that Mr Fisher is not familiar with the "highest type of spring wheel," since he states that the springs at the bottom of the wheel must necessarily be flexed in an opposite direction to those at the top of the wheel. His statement is true of most spring wheels, but there are wheels wherein the springs are all flexed in the same direction, whether at the top, bottom, side or any point in the wheel. This flexure is not necessarily slight, depending entirely upon the strength of the springs used, and in all cases there is absolutely no flexure of the springs during the revolution of the wheel except that caused by an irregularity in the roadway. There may be an initial resilience of one half inch for example, that is, a deflection of one half inch in the wheel from the weight of the machine, and yet there is no flexure of the springs in any direction during the revolution of the wheel in the movement of the car, except as before stated as is caused by irregularity in the roadway.

A wheel so designed with an extreme movement or resilience of one and one half inches and deflecting one half inch under the weight of the car may be weighted down by loading the machine to any point of deflection from one half inch to one and one half inches and at no point will flexure of the springs occur during the movement of the car over an even roadway.

This result is obtained by attaching the springs from one part of the wheel to the other at points found in a line parallel to the axis of the wheel—virtually a neutral point; thus a given movement in any direction from the neutral point must cause the same eccentricity of the points and the same flexure of the springs.

It should not be difficult for Mr Fisher to obtain details of a wheel of this description.

New York city HARRY E. SAPP.

Compressed Air as a Protection for Battleships

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to make some statements in connection with an article in SCIENTIFIC AMERICAN of March 22nd, 1913, on "Compressed Air as a Protection for Battleships." It [illegible] that "the various departments of [illegible] but our naval authorities to undertake a novel experiment more than a year ago." It is further stated that the test equipment on the armored cruiser "North Carolina" proved so successful that our battleships, including the "Pennsylvania," shall be equipped in the same way.

When, during the Russo-Japanese war, two Japanese battleships were sunk by mines I sent in April, 1904, to the Japanese minister in Washington, and later direct to the Japanese naval *attaché*, several letters for transmittance to the Japanese Navy Department, suggesting that they make their ships unsinkable by forcing entering water out by gas pressure. At first I suggested only self-inflating (by calcium carbide) balloons, later compressed air for inflating the balloons, and compressed air alone, without balloons. In a letter of April 20th, 1904 I stated that I intended not to divulge the idea until told that the Navy Department did not want it, in which case I intended to use it commercially or otherwise. The letters were acknowledged, and it was stated that they had been transmitted to the proper place. I never received a communication from the Japanese Navy Department, at least none referring to this matter. (A small contribution for the wounded was acknowledged by the paymaster of the navy.)

Three years later we had the "Japanese war scare." At a certain time so much was said about the probability of Japan going to war with the United States that I considered it my duty as a citizen to write to our Navy Department and state that during the Russo-Japanese war I had made some suggestions to the Japanese Navy Department, one of which was to make ships unsinkable by gas pressure, using either inflating balloons or compressed air alone, asking whether they wanted to know the other suggestions.

The Navy Department answered "Washington July 26th, 1907. Replying to your letter of the 13th inst., suggesting the use of gas to force water from compartments of vessels. You are informed that the Board on Construction, to which your letter was referred, reports that the ideas suggested by you are not novel, and are made use of in some cases in connection with wrecking operations. However, the Board is of opinion that the ideas suggested are not practicable nor desirable for naval purposes."

OTTO MEYER, Ph D

Richmond, Va.

The Value of Inventions

To the Editor of the SCIENTIFIC AMERICAN

The word *invention* literally means anything contrived for any purpose that has not been used or known to the prior arts. In a practical way inventions are understood to mean something designed to save time, labor, make money, and add to the advancement of civilization. Without inventions progress would soon cease and our vast continent would go back to the wilds.

If we were to take out everything in the United States that is founded on inventions, there would be little left. If George Stephenson or someone else had not invented the steam locomotive, the railroad systems of the world would never have had their existence. Had Robert Fulton not invented means of propelling ships by steam the ocean transportation companies would not be carrying millions of tons of valuable merchandise from seaport to seaport. If McCormick had not seen the possibilities of the self-binder, we would still be harvesting grain by band. After the cook stove, cotton gin, steam engine and a few other less important machines had been placed in working order, the greater number of the American people thought the climax had been reached, and there could be few more improvements made.

Edison, Westinghouse, DeLaval, Marconi, Boroughs, and Knight did not look at things this way. These great inventors believed that the field of invention and science was as great in their day as it was in Fulton's. So having this belief and an iron-bound determination these men began working on things that the supposed to be wisest men of the day thought was an impossibility to accomplish mechanically, yet they could not be influenced to give up the job, and after many years of unremitting toil and study these great benefactors perfected the seemingly impossible, which has added billions in wealth to our nation, and amply repaid them for their time and trouble.

Thousands of others have responded to this most noble and useful calling, which has kept the wheels of industry turning and the magnitude of commerce expanding from year to year. Not all inventions are profitable to our country or pay the inventor vast sums of money. Thousands of people fail in this line because their machines and devices are not practical, or else they have not sufficient means and courage to promote them.

Knowledge having no bounds, I believe the opportunities for the young American in this field are as great to-day as they were fifty years ago.

If we expect to maintain a steady advancement in progress, it is necessary to apply the knowledge we have gained by the experience of others to our designs in striving for still greater things. Having given this work several years of my time, I find the greatest requisite for success is self-confidence coupled with patience and thoroughness, for we all make mistakes. The greatest geniuses have made more mistakes than perfections, but as one success is worth more than many failures cost, it is well worth our time to use every influence in order to make the most out of the talent with which we are endowed.

For this country to continue in advancement, the Government must adopt measures that will thoroughly protect the inventors to the greatest possible extent.

Tunnel Hill, Ga. SAMUEL H KENNEDY

The Spring Wheel Problem

To the Editor of the SCIENTIFIC AMERICAN

Referring to a letter from Mr M K Donis in your issue of March 1st, please to allow me to state that in my humble opinion both Mr G F Fisher and himself are badly off the track in their ideas as to spring wheels. In my opinion a spring wheel is essentially and primarily a substitute for the pneumatic tire, the persistence of which latter, in the face of its enormous disadvantages, is sufficient proof of the fact that as yet the spring wheel is but a dream. Evidently Mr G F Fisher had in mind a type of spring wheel very common in the Patent Office records where a rigid ring is placed outside the rim and the intervening space filled with springs of some form such that they exert most of their force when the ring is displaced, along the line of displacement in compression on one side and tension on the opposite. Such a wheel would be one in which spiral springs were arranged radially. On the other hand Mr Donis has in mind only that form in which the springs are of such form as to offer equal resistance in all directions in the plane of the wheel combined with the above-mentioned rigid outer ring. Such a wheel is one in which the wheel is a disk with say six holes in it parallel to the axis and a large hole to clear the hub. The six holes each contain pins fastened into disks on the hub, forming a wheel which can thus be moved in any direction an amount determined by the looseness of the six pins in the six holes. Surrounding these pins are springs of various forms which are similarly affected no matter in what direction the movement may be. They may for instance, have the form of spirals like clock springs. Both these gentlemen seem blind to any other form of spring wheel whereas the ideal, o g, the one which most nearly approaches the pneumatic tire and the only one which can ever substitute for it *must* have a flexible and not a rigid rim. I was astounded lately in going over a pile of spring wheel patents to find one after another with the same old story of the rigid outer tire capable of slight movement against a spring of some peculiar form, whereby the inventor thought he could produce a substitute for air. In my mind the ideal spring wheel will be one in which the springs are so arranged that a small portion of the rim may be dented in and only the springs directly under the "dent" be affected. This wheel can strike a stone and pass over it with very little shock since only one or two of the springs will receive the pressure which cannot raise the wheel from its course simply because only one or two springs are not strong enough to sustain the weight, as the wheel will be so constructed that when resting on a flat surface, a large number (say ten) of the spring segments of which it is constructed will actually be in contact with the ground and sustain the weight. This is just the way the pneumatic tire behaves when on the road. The fallacy of the other arrangement can be shown to anyone who wishes to try the experiment, by placing a solid iron ring over a pneumatic tire and using it. It is as rough as a steel tire when so treated. Yet there is the most resilient form of spring known placed in a wheel. No form of spring, when placed inside a solid rim wheel can answer as well as that much added resiliency in the vehicle springs themselves, except that they may save the axles to a slight extent. I gravely doubt whether the added weight placed properly in the axles to add strength, and in the springs to add resiliency would not give much better results. In my opinion the spring wheel is not a thing which will be marketed in a small way or remain under a bushel. When it comes, the present demand, created by the entirely unsatisfactory pneumatic tire, will be too strong to allow it to stay undeveloped. But it has got to be good. It must be not a spring wheel at all, but a resilient spring flexible tire. Suppose the springs do not last? We now pay from $100 to $275 for four rubber affairs, which after three thousand miles of use sell for $1 00 to $2.75. As for me I would be willing to wear out a set of stamped steel springs even every one thousand miles instead of this *if I could ride as comfortably on them*. When the ideal "spring wheel" arrives, I will.

Meanwhile many a man can save himself the price of a useless patent if he will try the experiment and apply the reasoning above, and not think air can be simulated by a rigid ring resting on some "lucky twist" called a "resilient spring member."

City Point, Va. E. PAUL DU PONT.

Russia's Submarine Cruiser

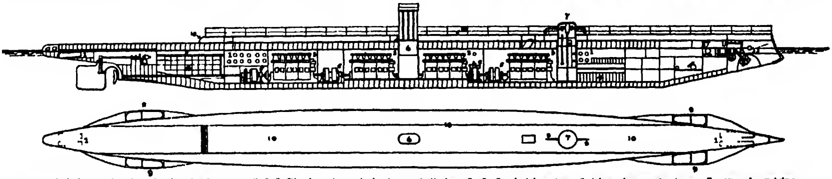
More Than Six Times the Tonnage of the Next Largest Submersible

By R. G. Skerrett

THE Russian government is determined to restore its fleet to the position it enjoyed prior to the war with Japan and to that end generous provision has been made for its rehabilitation.

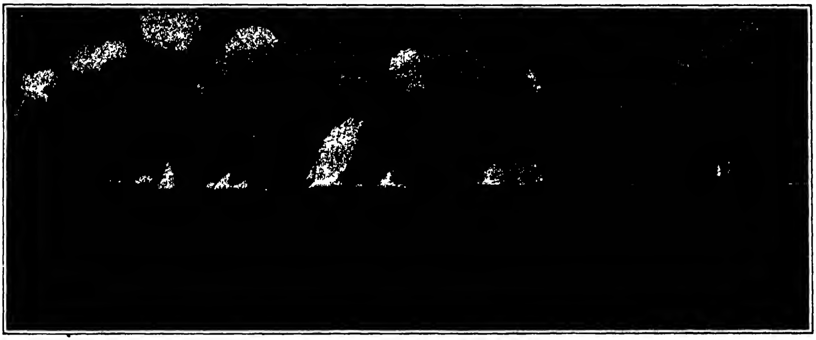
More than once Russia has startled the engineering world by her courageous initiative and again we see this spirit in the submarine cruiser which it is announced the Russian Admiralty will construct. The reader will naturally ask, What is a submarine cruiser? We can answer this best by making a comparison or, better, a contrast. The biggest submarine yet built for the United States Navy is a vessel of something just short of 500 tons displacement submerged, and the craft gether with the revolving turret forward, will be sheltered by armor varying from two to three inches thick. In the light surface condition, the cruiser is to have a displacement of 4,500 tons. This means that about 1,000 tons of water ballast must be handled and taken into the boat in order to get her ready for under-water work. The designer estimates that the vessel can perform this operation in three minutes, but this sounds too conservative in the light of experience with submarines of one tenth the displacement. It will probably take a good deal longer and the armor and the rapid fire guns will be very helpful while passing from the surface to the under water condition.

The biggest of the sea-going torpedo-boat destroyers to-day average about 1,000 tons, and these vessels have from three to four above-water launching tubes. These hornets of the sea make speeds of from 28 to 32 knots, and are absolutely defenseless against an enemy's rapid-fire guns. Here we have a boat of from 4,500 to 5,400 tons displacement, extensively armored, and capable of firing a whole broadside of torpedoes from their sheltered positions below the waterline. But this is not all. A 4,500-ton ship is far easier to drive and to maintain at a speed more nearly her maximum than a lightly built surface craft of less than one fourth this displacement. Therefore, the submarine cruiser, ton for ton,



1 1, 1 torpedo tubes 2 mine planting room, 3 3, 3 Diesel motors 4 4, storage batteries 5, 5, 5, electric motors, 6, telescoping conning tower, 7, armored revolving turret (housing) 8, rapid fire guns 9 submerging rudders, 10, armored superstructure

Inboard profile and plan of Russian submarine cruiser.



A Russian submarine cruiser of 5,400 tons displacement.

proposed for the Czar's navy is to have a submerged displacement more than ten times as great, i. e., 5,400 tons.

Quite six years ago, Mr Simon Lake planned and offered to the Russian government a mine-planting submarine torpedo-boat of large displacement, but the cessation of the war between Russia and Japan called a halt upon the project. Nevertheless, that design of American origin may properly be said to have influenced the Russian engineer, Schuravieff, in this later development of a kindred type, but beyond that the two vessels are widely dissimilar.

The submarine cruiser is to be virtually an under-water *torpedo dreadnought* and she is also to be capable of planting mines while operating submerged. The torpedo equipment will consist of 38 launching tubes with a supply of 60 long 18-inch Whitehead torpedoes. There will be 16 tubes on each broadside with two bow and two stern launching apparatus. The mine-planting equipment will provide for the carriage of 120 naval defense mines. The vessel will have a battery of five 4.7 inch rapid fire guns for the purpose of resisting the attack of surface torpedo vessels. These guns will probably prove useful in defending the submarine cruiser during the interval when she is passing from surface trim to a condition of readiness for submerged operations. As a further protection during this period, the inclined and flat portions of the superstructure, to-

We can get a better idea of the general character of this Russian craft from the following schedule of her principal dimensions

Length between perpendiculars		400	feet
Beam, maximum		34	"
Draught, surface trim		21.5	"
Draught, maximum submerged, to top of turret		29.5	"
Engines, explosive for surface		18,000	I. H. P.
Electric motors, submerged propulsion		4,400	"
Speed, maximum, surface		26	knots
Speed maximum, submerged		14	"
Radius of action, surface	at 11 knots	18,500	miles
	at 21 knots	1,250	"
	at 25 knots	730	"
Radius of action, submerged	at 6 knots	275	"
	at 8 knots	154	"
	at 10 knots	80	"
	at 12 knots	42	"
	at 14 knots	21	"

A vessel capable of attaining the foregoing speeds and radii of action above and below water should certainly prove a very *formidable* adjunct to the coast defenses of any country, and it is plain to see that the relatively sheltered waters of the Baltic would provide an ideal field for the operations of a craft of this nature. A submersible cruiser of the present dimensions would be able to weather any gale and to hold the sea for a long period. In fact, the ship is designed to carry more than 300 tons of liquid fuel and be able to run from the Baltic around to Russia's naval base upon the Asiatic shores of the North Pacific.

will be a far more dangerous antagonist than a similar total displacement divided among four sea-going ordinary destroyers. Apart from this, the Russian vessel could conceal herself if she chose, and this the surface torpedo boat cannot do.

Two unusual features of the submarine cruiser are the armored revolving turret forward and the conning tower amidships, both of which telescope and can be housed within the contour of the protected superstructure. The questionable feature of the design is the employment of storage batteries for submerged propulsion.

The naval defense or contact mines, 120 in number, are to be carried in one of the after compartments, where they can not only be assembled, but launched through hatches leading outboard through the bottom. The mines can be planted while the boat is submerged. The Russians know all too well the destructive power of this form of under-water attack, and a submarine vessel provides an ideal medium for sowing a field secretly. The moderate depths of the Baltic lend themselves easily to this form of subaquatic defense.

The largest submarines or submersibles now under construction abroad are in the neighborhood of 800 tons submerged, and the naval world will await with interest the building and the performances of this Russian cruiser. Every material increase in the size of a submarine adds [illegible] to the problem of [illegible] rapidly submerged and [illegible] her.

New York State Barge Canal

Completing One of the World's Greatest Engineering Works

By Noble E. Whitford, Resident Engineer

ONE of the chief characteristics of the early years of the twentieth century is the rapid and almost universal substitution of the machine—the product of man's brain—to do the work formerly accomplished by his hands.

This statement is no new enunciation, but the repetition of a recognized fact, cited here because the subject of this article illustrates its truth so strikingly

New York State is engaged in enlarging and modernizing its canals—a system of waterways that were begun nearly a hundred years ago, when much of the territory they traversed was still the primeval forest Thus the old and the new stand in such close proximity and the contrast between the two canals is so marked —in circumstance and method of building, in the finished product and in the result attained—that a comparison shows the strides of a century's progress.

Times and conditions have greatly changed since a day, now ninety years past, when the arrival of a boat in New York city from the head of Seneca Lake was deemed of such importance that its owners, two farmers of Tompkins County, were given a public entertainment by citizens of New York and were presented with a memorial cup. This was the first boat of any size to come from so far in the interior, and she had sailed much of her course over a canal then building, which was the marvel of its day Conditions of the time are reflected in the fact that the timbers and cargo of this boat came from the forest and fields near where she was built, her owners were her architects, builders and navigators her crew was composed of the men who had cultivated her cargo, and even her sails and rigging were manufactured by her owners, the materials for them having been grown on their farms.

When, two years later, the whole of this new waterway was completed, the Governor of the State led a triumphal voyage that extended across the whole length of the commonwealth and lasted for ten days, ending with a pageant in New York city, the like of which had never before been seen on this side of the Atlantic

For a half dozen years and more, New York State has been engaged in another great canal project—one of the greatest engineering feats of the time—but there has been so little ostentation in prosecuting the work, and its building has been so overshadowed by the contemporaneous construction by the United States of a more spectacular canal, that perhaps it is not strange that so few people, even among our own citizens, appreciate the magnitude and importance of the enterprise which is being rapidly pushed toward completion.

When it is known that the amount of work required in building the barge canal (such as yardage of excavation and concrete and the like) is about three quarters of that at Panama, while its length is more than ten times that of the Isthmian waterway, there comes an appreciation of New York's undertaking. It is significant, moreover, that the barge canal, including the construction of terminals at more than fifty cities and villages, is being built for about one third the cost of the Panama canal

The near approach of the final completion is told in certain statements contained in the annual report which the State engineer has recently transmitted to the legislature. He says that the failure of contractors on the Champlain canal has delayed the anticipated completion of that branch in 1913, and that the best to be expected is that it will be finished in 1914. He anticipates that the Oswego canal and the portion of the Erie canal lying east of the Oswego junction will also be completed in 1914, thus opening navigation from Lake Ontario to the ocean. He says that probably by 1915 the western section of the Erie and the whole of the Cayuga and Seneca canal will be finished, thereby completing the entire barge canal system.

On January 1st, 1913, the value of work that had been put under contract amounted to $77,324,644. Of the whole project only about four per cent, in length of the canal, remains to be awarded. The total value of work performed to the same date was $53,909,587, or 70 per cent of that under contract. If we consider all contemplated work as under contract, then this amount already done would be a little more than 60 per cent of the whole project.

At several places portions of the new canal have already been in operation for some time. Where conditions permit, traffic is turned into the new channel as soon as it is completed. One lock has been in commission for three years, although full operating machinery has but recently been installed. Of the finished sections, the locks probably furnish as interesting features as any Some half dozen of these had received their electrical equipment last spring, and some of them were so located that traffic was turned through them At Whitehall, at the head of Lake Champlain one might have seen a good example of a new lock, for this structure was in full operation during the season passing boats of the old canal dimensions, usually in groups of six, since they were towed up the lake in fleets of a dozen or more

A visit to this lock furnishes a most striking demonstration of the superiority of the barge canal over the old waterway, for the locks that are now passing are but little changed from those used in the original canal a hundred years ago Entering the power house at the foot of the new lock, we find an electrical equipment, in duplicate, complete and of the latest approved design in every particular It is necessary to keep this machinery running only during actual lock operations, since, within 50 seconds after water has been turned into the turbines lights in controller cabinets on the coping indicate that the current is on the line in readiness to begin a lockage at full speed.

Probably nowhere along the line of the canal will the march of progress be seen more distinctly and the contrast between the old and the new appear more sharply than in comparing the barge canal lock tender with his brother of the old canal. The latter with his back against a great balance beam and his feet pressing a cleated pathway, might have been seen straining every muscle to close one of the gates, then running across a bridge over the lock to close the opposite gate next racing to the other end of the lock and out upon the gates to seize and raise the valve lever, and after the boat had been raised or lowered repeating the operation all of which had to be performed by main strength at each lockage and even then only 240 tons of cargo had been locked through. The barge canal lock tender at his operating stand near one of the gates, throws successive switches, first to open the gates for the incoming vessel, then to draw into the lock by means of a capstan the boat or, perhaps, a pair of boats traveling tandem or a fleet of four, with their loads of 3,000 tons or more in the pair or fleet. Another switch opens the valves for filling or emptying the lock, both gates and both valves being controlled from either side of the lock without crossing over All of these operations are performed by electrically-driven machinery which receives its current from the nearby power house, the head of the water created at the lock furnishing the motive power

At some of the completed locks records have been kept to determine the average time for performing a lockage. Assuming that the lock is ready for the entrance of the boats, the time required for hauling a fleet into a lock is 7 minutes, and during this time the upper valves are being closed, which operation requires one minute As soon as the fleet is in the lock, the upper gates are closed, and this takes 45 seconds. The attendant walks from the upper to the lower end of the lock in 1¼ minutes. The opening of the lower valves requires 1¼ minutes. The emptying of the lock takes 5½ minutes, and the opening of the lower gates 45 seconds. Then the getting of the fleet out of the lock consumes 5 minutes, making the total time for a complete lockage 21¼ minutes.

The past year has witnessed the completion of one noteworthy canal structure—the dam that impounds the water to form the Delta reservoir This dam, which stretches across the upper Mohawk valley with a length of 1,100 feet and a height of 100 feet above the lowest foundation, is the chief feature of one of the two projects that will add two lakes to the map of the State. The Delta reservoir, or Delta Lake, as the people in the vicinity prefer to call it, is four miles long and two miles wide at the base of its triangular shape. It reoccupies the basin of an ancient glacial lake. The arrangement of the surrounding hills suggested to the early settlers the name which they gave to the hamlet that nestled in the western part of the valley This village of Delta has now been obliterated, its site lying beneath the waters of the new lake

The capacity of this reservoir is 2,750,000,000 cubic feet. Although built primarily for supply purposes, its regulating ability will be considerable The present low-water flow is from 100 to 150 cubic feet per second and the maximum flood discharge of which we have record is about 8,200 cubic feet per second It is estimated that, when the gates are properly regulated, the reservoir will limit all summer floods to about 2,500, and winter floods to 3,600 cubic feet per second, thus saving much damage to property in the Mohawk valley

Work is now progressing on the second great reservoir that at Hinckley, which is located in the foot hills of the Adirondack Mountains, where the drainage basin of West Canada Creek above this point has an area of about 372 square miles. The dam for this reservoir will be in the main, an earthen structure with concrete core wall Its total length will be 3,800 feet the masonry portion being 500 feet long The reservoir, which will measure 13 miles counting both branches has a capacity of 1,445,000,000 cubic feet In regulating floods this reservoir also will have considerable influence The natural flow of the stream has a wide variation, ranging from 110 to 40,000 cubic feet per second. It is estimated that proper regulation will reduce a flood of 40,000 cubic feet to one of 19,000 per second, or less than half the maximum rate

During the past year or two, several interesting phases have been added to the canal question. Among them the terminals rank first The State was somewhat slow in beginning that part of its transportation system which a railroad company would consider first, but the work of providing suitable terminals is now being pushed rapidly to have them in readiness for the opening of the canal

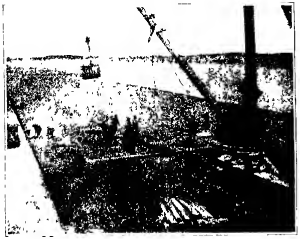
The legislature of 1911 ordered a survey of the Black River between Carthage and Sackets Harbor on Lake Ontario, to determine the feasibility of making that stream a part of the barge canal system A bill to provide funds for this addition received favorable action at the hands of the legislature of 1912 but a measure for supplying additional highway funds was given precedence, and only one referendum carrying an appropriation may be submitted to the people at any general election Probably this subject will come forward for public attention later

Another matter that will demand future consideration is contained in a recommendation recently made by the State engineer to the legislature The locks will accommodate boats of 42 or 43 feet beam, but two such boats cannot pass in certain sections of minimum bottom width In the stretch of 185 miles between Lake Ontario and the Hudson River by way of the Oswego and Erie canals, there are only about fifty miles of this minimum width. The State engineer has recommended the appropriation of an extra two million dollars to widen these sections and thus to provide a passage for boats of maximum lock capacity from the ocean to Lake Ontario and through the Welland canal to all of the Great Lakes The use of vessels of 3,000 tons capacity or over, would be possible by this change

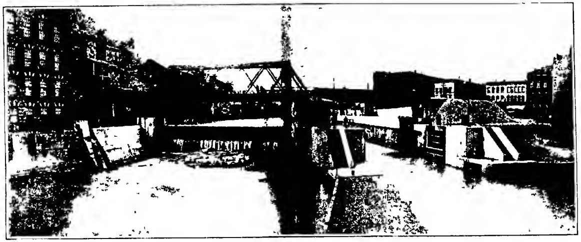
Last summer the passing of two parties of excursionists from foreign lands over the line of the barge canal showed that its fame is recognized beyond the limits of the home country These parties traveled by private excursion trains and were composed chiefly of representatives of foreign governments, being men who are eminent in engineering and other scientific pursuits. Representatives of the State engineer's department acted as personal guides, and much interest was manifested

A New Method of Fertilizing the Soil

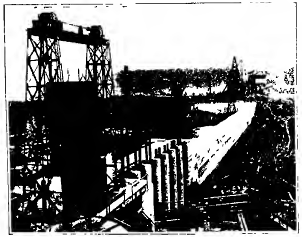
A NEW method of applying chemical fertilizer to fruit trees is proposed by M Cadoret and he finds that it gives much better results in experiments which he has been making in France The usual method is to simply spread or strew the chemical fertilizer on the ground at a certain distance around the trunk of the tree, but the author finds that this has a disadvantage in that the fertilizing principles do not penetrate into the ground as rapidly as might be supposed so that their action is felt but slowly He finds that a much better plan is to use an iron rod having an expanded part near the point so as to make rather large holes in the ground Such holes are filled with the fertilizer, which consists of a properly prepared mixture using some precautions. The fertilizer in order to prevent damage to the roots from the caustic action, should be mixed with crumbled earth beforehand. From four to six holes should be used deep enough so as to contain all the fertilizer required for the tree in question and the holes are best placed about 12 inches from the trunk. The depth of the holes is increased to keep pace with the growth of the tree According to the author the above method gives remarkable results, and he finds that peach apricot cherry and other trees of five years growth are as well developed as other trees of twelve years. The method has the advantage that it does not imply any extra cost. Two men can treat eighty trees a day in this way



Laying concrete in trough, Irondequoit Creek crossing



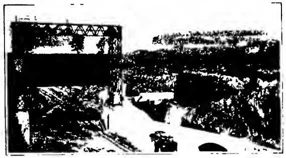
The canal where it enters Lake Champlain. Note movable dam and lock



Head gates and Vischers Ferry dam, 2,000 feet in length

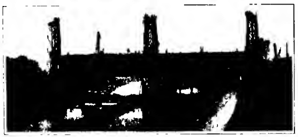
Trussed arch bridge across canal

Lock No. 2 at Waterford, eastern terminus of Erie canal



Guard gate at head of cut off between Mohawk and Hudson Rivers

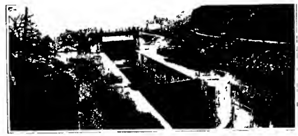
Installation of power and light turbines at Crescent dam



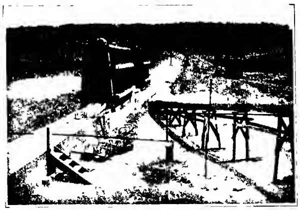
Typical guard gate for cutting off damaged section of canal

Bridge in embankment section before embankment was placed

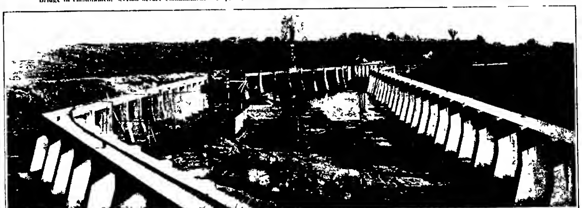
Completed channel in rock cut near Rochester



The lock at Little Falls with lift of forty and one-half feet



Building concrete core wall for dam at Hinckley reservoir



Pool between two of Waterford flight of locks. Concrete docking bordering channel within pool

Completed dam at the Delta reservoir

BUILDING THE BARGE CANAL OF THE STATE OF NEW YORK

Inventions New and Interesting

Simple Patent Law, Patent Office News, Notes on Trademarks

A Moth-proof Fly Book

THE importance and value of having a thoroughly good fly book is something that every angler for trout, bass or salmon realizes. Since the earliest days of casting the artificial fly a safe and convenient means of transporting them to and from the stream and of protecting them against moths has been a necessity. To-day, with modern skill and more particularly the adaptation of celluloid to various purposes, we have reached the point where it is possible to make a moth proof fly book which is in every respect practical. The accompanying illustration shows a book invented by F. J. Cooper of San Francisco. It is constructed on the loose-leaf principle so that it is possible for the angler to take with him just such flies as he will be likely to need on his trip. The envelopes or leaves are manufactured of a fine linen on the lower two thirds and of celluloid on the upper third. The entire envelope and flaps are strongly bound with twine to make them durable. The angler will readily appreciate the value of this celluloid upper portion, for it enables him, at a glance, to select the required fly and avoids the entire necessity of handling flies which are not wanted. It also avoids the possibility of friction, which in the case of the more delicately constructed flies is a matter of considerable importance. On the flap of the envelope is left a space on which the name of the fly may be written. Any number of envelopes may be secured and used as a safe filing place for the angler's stock of flies. The book is provided with a separate linen envelope for leaders, also a solid leather pocket for other requisites of an angler's trip. Ample space is allowed for six or eight fly envelopes. Being completely inclosed, the flies are protected from moths.

A moth proof fly book.

Fishing Reel

THE fishing season is close upon us, and every follower of Walton will soon be thinking of going over his outfit in preparation for the season's sport. Next in importance to his rod, if not as important as that article, is his reel. All who have cast a live bait, spoon or fly, know the value of a thoroughly substantial and reliable reel.

In this part of his equipment, as in all things connected with angling, simplicity is of the greatest importance. A reel which has recently been put upon the market is shown in the accompanying illustration. In appearance it is in keeping with the finest outfit, but appearance is not its only good quality, for its mechanism is of the simplest kind, yet it is constructed so as to overcome many of the difficulties encountered in casting, such as the tendency of the spool to overrun, the wedging of the line at the ends of the spool, and the spoiling of the line by thumbing the outside layers, for with this reel it is not necessary to touch the line in casting.

The thumbing lever, by which the spool is freed and the brake applied to the center of the spool, make it possible to control the bait at will. When the thumbing lever is pressed down to hold the spool tight, preparatory to the cast, it automatically throws out a crank and gear mechanism, so that the spool revolves freely. After a cast is made to wind in, you merely press the crank toward the reel and this throws the clutch back to action, the spoon turning with the crank. It is extremely simple. Press the lever and the spool is free. Press the crank and the spool is again in engagement.

A simple fishing reel.

The frame of the reel is of German silver, with the crank end removable, making the spool and other operating parts readily accessible. The spool is made from aluminium. As a reel for bait casting particularly it is of unusual value to anglers, for upon releasing the lever, the bait easily accelerates the light spool, which is unhampered by either crank or gears. The bait is thus permitted to attain high speed.

A Gearless Automobile Differential

By Ross Babcock, M. E.

BY way of overcoming the shortcomings of the very common type of automobile differential mechanism, there recently has been brought out by a Detroit inventor a new style of gearless differential in which the problem of obtaining equal distribution of power to both driving wheels has been attacked in a manner that differs from any other. Not only are gears eliminated, but springs and friction devices also are missing, for which reason great claims are made for it. Whether it ever will come to anything remains to be seen, for its manufacture suggests a number of difficulties that it would seem must result in rather high production cost, this fact is made plain by the accompanying illustrations. In the mean time, however, it is being tested on a heavy commercial vehicle by one of Detroit's greatest axle makers, and the results of the tests will determine largely its future.

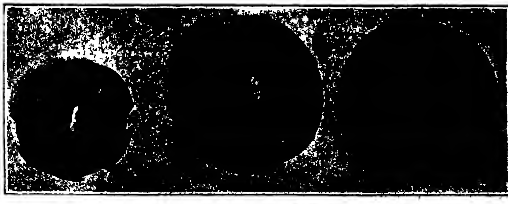
The construction of devices of a similar nature has been attempted before, as witness the patented inventions of such noted engineers as Thomas B. Jeffery and Alanson P. Brush and others, though in the new gearless differential the principles adopted or adapted by others in attempts to solve the problem have been relegated to the background.

In its simplest aspect, the device is an adaptation of the well known ratchet and pawl mechanism, though it differs from it in that both springs and ratchets are eliminated. The place of the former is taken by gravity alone and the place of the latter is taken by small cylindrical pins which are free to move within peculiarly shaped slots. The device illustrated was developed for use on commercial vehicles, two being employed, one on either end of the driving jackshaft, which is solid and is driven in the orthodox manner by means of a ring bevel gear and pinion from the engine.

The outer member *A* has its inner periphery recessed as shown, one set of recesses serving for forward drive and the other set serving for reverse and braking. A plate mounting the driving chain sprocket is bolted to this member and serves also as a cover for the mechanism. The inner member *B* is slotted as shown in the picture and the slots house five cylindrical pins C^1, C^2, C^3, C^4, C^5.

In operation, when the inner member *B*, which is splined to the driving axle, is rotated, one of the pins rolls around its slot to the position shown in the picture C^1, thus preventing further movement of the inner member without moving also the outer member *A*, to which the driving chain sprocket is attached. The drive thus is dependent upon a single pin. In the reverse direction the other set of pawl pins comes into action. In order to minimize the jar coincident to starting from rest the pawl cams at either end of the jackshaft are set one 45 degrees ahead of the other, so that one eighth revolution of the driving shaft in either direction serves to lock the driving and driven members.

When the vehicle is being driven along a straight road, the pawl cams on each side lock and transmit the power equally to both wheels, provided the coefficient of adhesion between each wheel and the road is the same. Immediately a curve is reached, however, the outer or faster running wheel over-runs its pawl cams and the inner wheel receives all the power. When one wheel encounters slippery roadway, the lack of adhesion between wheel and road operates to release the pawl cams on that side and the drive then automatically is taken by the other wheel, where better traction is obtainable. Under similar conditions with the ordinary type of differential all the power would be transmitted to the slipping wheel and it would continue to slip, performing no useful work. Hence, the gearless differential would seem to be a better equaliser than is the other.



A gearless automobile differential.

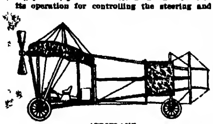
Advertising Device to Show Wear of Stockings.—Most of the wear on hosiery comes at the toe and heel. A patent, No. 1,082,[illegible], has been issued to the United Demonstrating-Machine Company of Columbus, Ohio, as the assignee of Ernest S. Jaros of the same place for an advertising device in which two stockings are spaced apart and a sledge vibrates between the two, striking alternately the heel of one and the toe of the other, and a register indicates the number of [illegible] hammer, [illegible] determine[illegible] strokes of the sledge [illegible] necessary to wear out the stockings.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Aviation.

AEROPLANE.—W. D. SCOTT, Box 92, Springwells, Mich. This inventor provides means for producing a warping effect without impairing the structural strength of the carrying planes, provides a mechanism universal in its operation for controlling the steering and



AEROPLANE.

warping devices harmoniously, provides a tail carrying plane for steadying the horizontal poise of the machine, provides a system of duplex steering rudders to augment the effectiveness thereof, provides a structure for the planes which augments the strength without materially increasing the weight thereof, and provides means for steadying the operation of the planes in their passage through the air.

Of General Interest.

COMBINED TEETH SEPARATOR AND MIRROR.—B. L. MILLER, 324 Wall St., Kingston, N. Y. The invention refers to dental appliances, and the aim is to provide a form of combined teeth separator and mirror arranged to permit of illuminating and reflecting the cavities of teeth to be filled, or to illuminate the teeth while polishing a completed filling.

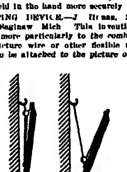
ATOMIZER.—N. BACHMANN, Haida, Bohemia, Austria-Hungary. In this device the fixing of the piston rod simultaneously secures the suction valve in its closed position. This not only produces a double obturation by the fixing means and suction valve, but the latter acts directly as a firmly inserted stopper so that in an atomizer of this kind scentive and volatile perfumes and the like can be kept for a long time as well as in a tightly stoppered bottle. Thus perfumers can market their products directly in atomizers, which has not hitherto been the case.

Hardware and Tools.

HINGE.—F. W. HESTER and P. KLINE, 908 State St., Racine, Wis. The invention provides a hinge which can be used for the various purposes to which hinges are usually put which can be readily attached to or detached from the door frame or other support, without the removal of retaining bolts, screws or nails, and which cannot be easily accidentally detached.

TAPE CASE.—G. F. PUTNAM, care of Standard Rule Co., Flint, Mich. In the present invention the principal object of the inventor is to provide a new and improved tape case, the construction of which presents a series of corrugations or roughened portions between the opposite sides thereof whereby the case may be held in the hand more securely.

CLAMPING DEVICE.—J. HUMAN, 220 N. 4th St., Saginaw, Mich. This invention has reference more particularly to the combination with a picture wire or other flexible member adapted to be attached to the picture or other



CLAMPING DEVICE.

article to be hung, of a clamping device by means of which the effective attachment between the picture and the flexible member can be varied to vary correspondingly the angularity with the horizontal of the article when it is hung.

Heating and Lighting.

RADIATOR.—S. H. T[illegible], care of [illegible] Co., Columbus, Ohio. The invention relates to a form of gas stoves and radiators, and an object of the improvement is to construct a gas stove having relatively [illegible]

ACETYLENE GAS GENERATOR.—J. F. WILLIAMS, 41 Warren St., New York, N. Y. In this generator the amount of carbid in the feed hopper is indicated at all times, and an alarm is sounded whenever the carbid in the feed hopper reaches a low stage, and whereby a supplementary charge of carbid within the hopper may be added to permit of running the acetylene gas generator another length of time, say overnight, before being required to recharge, thus avoiding recharging during the night or running out of gas and thereby avoiding the consequent extinguishing of the lights.

Household Utilities.

ROPE CLAMP.—F. A. WASTER, 90 Madison Ave., Perth Amboy, N. J. The clamp is provided with a member which may be used as a handle the member extending through a cut-away portion of a guide arm, which is pivoted to the member so that the movement of the arm relative to the member is limited in one direction by the contact of the member with the arm. The invention is especially well adapted for operating pulley lines.

ADJUSTABLE BRACKET.—E. CHANAL, 2170 Amsterdam Ave., New York, N. Y. An object here is to provide an inexpensive adjustable bracket easy in its manipulation and positive in its action, that can be easily put on or off from the supporting place. Another object is to provide an adjustable bracket that will permit a displacement of the supported object without displacing the bracket itself.

FLY TRAP.—J. B. MEADOWS, P. O. Box 138, Yukon, Okla. This inventor's more particular purpose is to produce a device which is sanitary, and in which the parts are so constructed and fitted together that they may be readily nested for purposes of shipment and readily placed together to form the complete trap.

Machines and Mechanical Devices.

TORPEDO PLACING MACHINE.—J. D. HALL, Arcadia, Kan. This invention provides means whereby a plurality of torpedoes may be successively and rapidly deposited on the rail of a railway bed, and simplifies the construction so that the retraction of the holder, after the deposit of one torpedo, disposes a succeeding torpedo in position to be deposited.

SUBMARINE MINE.—G. E. ELIA, Hotel de Crillon, Place de la Concorde, Paris, France. In this case the spring controlled striker is connected to the anchoring device in such a manner that its movements relatively thereto are controlled by a movable arm which on the mine being struck, is so moved as to allow the striker to be automatically cocked and then released to cause explosion of the mine.

GEARING.—E. W. F. HERRMANN, 120 Hays St., San Antonio, Tex. This invention relates to gearing, and an object is to couple up at will two independent drive shafts with two independent engines, so as to direct either engine with either shaft, both engines with either shaft, or both engines with both shafts.

VENDING MACHINE.—J. J. MARKS, Harrison, Ark. The purpose here is to provide means which, when freed by a coin, are adapted to operate to discharge a newspaper or other periodical from within the casing. Another purpose is to provide means which may be readily adjusted to regulate the tension of the spring connected with the lever, so that one, two, three or more coins will be required to operate it.

APPARATUS FOR DISPENSING TOWELS, NAPKINS AND THE LIKE.—P. G. MERRITT, 1081 Berlin St., New Orleans, La. The object of the present invention is to provide an apparatus for containing and dispensing towels, napkins and similar articles as they are required for use and more particularly to contain and dispense such articles assembled in the form of rolls, such rolls of articles being produced by a rolling apparatus forming the subject matter of a filed application.

HYDRAULIC AIR COMPRESSOR.—C. HALRICH, 35 Uhlerring, Cologne, Germany. This inventor makes the separating and storage chamber and sometimes the descending pipe also, of rubber-coated fabric, so that the apparatus can be assembled above ground, then lowered through the narrow shaft in a folded or rolled condition, and finally expanded or inflated in suitable manner. As these can take place without difficulty under water when his apparatus is employed it is not necessary to pump out the water or to provide tubbing and consequently it can be used in even very wet or flooded ground. The means employed enables hydraulic compressors or accumulators to be sunk and anchored in the sea.

WEIGHING SCALE BALANCING LEVER.—C. M. STUBOIS, 1601 Fifth Ave., N., Birmingham, Ala. This improvement provides a lever adapted to receive the balancing edges and links therefor in guided relation, provides a simplified construction for said lever without diminishing the strength thereof, and provides an economical form of construction for the said lever.

PROPELLER.—G. A. SMITH, J. E. BROOKS, G. E. BOWMAN, and H. E. SLAVEY, address George A. Smith, Wilmington, Cal. The invention pertains to propellers of the reciprocating type, and comprises a pair of leaves or blades pivoted together and connected to the end of a reciprocating rod, such as a piston rod, and provided with means which control the opening and closing of the blades.

APPARATUS FOR BENDING AND CUTTING STEEL RULES AND OTHER METAL BARS.—J. A. RICHARDS, Albion, Mich. The invention is in certain features an improvement upon the rule-bending apparatus for which Mr. Richards has received Letters Patent No. 998,894. In the present invention he has combined improved means for bending, shaping, and cutting rules and other bars, whereby important advantages are attained.

DRIVING MEANS FOR GRAMOPHONES.—F. G. HAYWARD, 50 Convent Ave., New York, N. Y. The object here is to so improve frictional driving means as to provide for a substantially constant pressure upon the driving face of a transmitting disk even though certain of the friction wheels co-operating there with may be shifted in relation to one another or the axle of the shaft upon which the said disk is mounted.

PACKING BOX.—W. T. SNELL, Bisbee, Ariz. The invention relates generally to a form of packing box in Letters Patent No. 1,018,958 granted to Mr. Snell. The present invention is directed to a box characterized by an arrangement of parts whereby the packing will follow the piston rod or equivalent element when the rod or element runs out of center.

MACHINE FOR THREADING TAPES INTO BUTTONS AND OTHER ARTICLES.—L. ROSERMAN, care of W. Ranbitschek, 174 North 4th St., Brooklyn, N. Y. For the purpose of this invention use is made of an abutment for the article to rest on and a tape carrier adapted to pass through the apertures in the article and adapted to carry a tape and draw the ends through the said apertures in the article.

YARN STRIPPER.—J. W. MULLIKIN, care of John P. King Mfg. Co., Augusta, Ga. This invention pertains to yarn strippers employed for stripping threads and yarn from bobbins and quills, in order that the latter may be filled with a new thread or yarn. The inventor seeks to provide a simple mechanism by aid whereof the thread (usually termed in this art as the yarn) is readily slipped off from the bobbin or quill.

VENDING MACHINE.—C. A. BRYANT and C. H. ROUNDS, Passaic, N. J. This machine is more especially designed for vending keystone-shaped flat drinking cups in public places and the like and arranged to insure the delivery of a cup after the proper coin is once introduced and a controlling handle is manipulated, and to prevent the delivery of a cup unless the coin is first introduced.

APPARATUS FOR USE IN THE TREATMENT OF DEAFNESS.—A. ROSENBERG, 250 High Holborn, London, W. C., England. This device treats deafness and other disorders of the auditory organs and by agitating the sound conducting and sound perceiving portions of the ear by means of mechanical vibrations having a continuous undulatory character corresponding to that of the sounds (speech music and the like) to which it is required to train the ear to respond.

CLOCK WINDING DEVICE.—C. T. BERNHARDT, Box 544, Salisbury, N. C. In the present patent the purpose of the invention is the provision of a clock winding device in the form of a self contained unit attachable to the spindle of the winding barrel of the clock, and bodily removable therefrom when desired.

LATH MACHINE.—T. H. HYDE, care of E. Patton, 1000 Fifth Ave., New Kensington, Pa. This machine is for use in expanding sheet metal into an open work fabric. The present forms of machines are objectionable in that they are formed of a large number of parts which are quite apt to get out of order and the replacing of which parts is difficult and expensive.

SLOT MACHINE.—A. H. BOWMAN, 134 So. 14th St., Allentown, Pa. This invention relates more particularly to that class of machine adapted to dispense gum or other commodity upon the insertion of a coin in a slot. An object is to provide a device which will allow the passage of coin, but which will intercept washers or slugs.

CLOTH PILER.—J. LAUGHTON, care of W. H. Rich & Son, 768 Pacific St., Brooklyn, N. Y. The present invention refers to cloth pilers and more particularly to cloth pilers adapted for use in handling fine textile fabrics such as silks used in manufacturing umbrellas and parasols. It provides a carriage also guides which acting upon the material as it is paid out from the cloth laying carriage causes it to be properly laid and positioned on the cutting table.

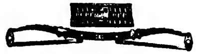
Railways and Their Accessories.

CAR SEAL.—J. W. BOWSE and H. W. GREEMAN, care of Harvey W. Greeman, 222 W. 4th St., Seymour, Ind. The seal comprises a body member and a co-operating extension carried thereby, it is obvious that the sizes of the body member and the extension may be varied in order to adapt the device to different uses, the materials of which the parts are made being also capable of wide variation without departing from the inventive idea.

CAR WHEEL.—G. T. POTTER, Connellsville, and C. B. PRITCHARD, Everson, Pa., and O. L. MARQUET, address the last named 907 Market, Steubenville, Ohio. The invention provides a cover for a lubricant-box, which may be quickly and readily removed to expose the major portion of the interior of the box; and provides delivery passages for the lubricant to guide the same laterally over the journal bearing of the axle whereon the wheel is mounted.

Pertaining to Vehicles.

SPRING SUSPENSION FOR VEHICLES.—H. L. HUBBARD, 223 W. Willis Ave., Detroit, Mich. In this patent the inventor brings out an improvement wherein the section of a



SPRING SUSPENSION FOR VEHICLES.

frame shows a movable steel block operating between two coil springs which can be used in connection with a spring hanger frame attachment either for the use of the half elliptic spring as used on gasoline motor cars or the radius rod adjustment as used on electrics.

VEHICLE MOUNTING.—A. A. PRATT, care of Beardsley, Hemmens & Taylor, 54 Wall St., New York, N. Y. The invention here is to provide a mounting or suspension arranged to insure easy and comfortable riding to the vehicle without requiring the use of pneumatic or similar tires, thus reducing tire expense to a minimum and eliminating danger and delay caused by bursting tires and the like.

FLUID TRANSMISSION FOR MOTOR VEHICLES.—E. B. VAUGHAN and F. T. KLAHSEN, Cleveland, Ohio. The improved power transmission apparatus employs a circulating turbine driven by a motor and in circuit with two turbines on a reversible drive axle. The propelling turbines may be reversed, there being for the purpose controlling valves in the liquid circulating circuit whereby the liquid may be directed either under or over the propelling turbines to turn them in either direction for forward or reverse drive.

Designs.

DESIGN FOR A WIND SHIELD.—W. H. DOUGLAS, Belleville, N. J., care of Healy & Co., 1652 Broadway, New York, N. Y. In this attractive design for a wind shield the shield holds two oval-shaped glass protectors ornamentally set in the frame supported by posts.

DESIGN FOR CARPET OR RUG.—J. G. PEGEL, Thompsonville, Conn., care of G. S. Squire, 25 Madison Ave., New York, N. Y. Mr. Pegel has obtained patents on four designs for a carpet or rug, all of which are oblong in form and ornamented with a border inclosing the scene presented. Design No. 43,775 shows pictured on the field of the rug two little children at seesaw with a small dog standing midway of the opposite ends of the plank. Design No. 43,776 shows a park scene with a boy and girl handling three pet dogs. Design No. 43,777 depicts an outdoor scene wherein five small girls are romping around a path in single file and holding the bottom of one another's skirts. Design No. 43,778 represents a garden inclosure with a girl playing with four kittens and a very large sized dog.

DESIGN FOR CARPET OR RUG.—W. E. NATERS, Thompsonville, Conn., care of G. S. Squire, 25 Madison Ave., New York, N. Y. In this ornamental design for carpet or rug an outer and an inner band with ornamental patterns comprise the border. The field with its centerpiece is designed in very attractive geometrical figures.

DESIGN FOR A CARPET OR A RUG.—W. O. DEWSNAP, care of G. S. Squire, 25 Madison Ave., New York, N. Y. In this ornamental design for carpet or rug inside of the somewhat plain border flowers and scroll work are in profusion. The centerpiece is very attractive with its design of flowers and scrolls.

DESIGN FOR A TUMBLER.—W. E. HUSTER, Morgantown, W. Va. In this design for a tumbler the glass is of straight vertical outline. The ornamental feature comprises a single narrow twisted band around the upper part and another below looped around the article.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

End Dump Bodies for Commercial Vehicles

(Concluded from page 3[illegible])

nut *11* to travel either up or down raising or lowering the body.

Passing from the screw and nut operating mechanism, the rack and pinion mechanism illustrated in Figs. 4 and 4A probably is the simplest of all those illustrated. It is so simple in fact that it scarcely requires explanation. The curved rack *12* is attached to the body and operated by the pinion *13* which in turn is operated through a train of gears giving the required reduction. A hand crank connected at *14* serves to operate the train of gears and the muscle of the driver is the elevating energy.

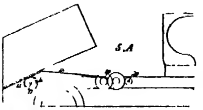
In Figs. 5 and 5A the rack and pinion principle also is employed, though the method of application is quite different. The rack *15* is mounted on the body. Rotation of the pinion *16* by means of a crank attached at *17* serves to move the body backward until it over balances and tips itself. To draw it back into position a chain *18* winding on a drum *19*, which is operated through a train of gear wheels set in motion with a crank attached at *20* is employed.

With the aid of a special "fifth wheel" arrangement the body illustrated in Fig. 6 has been made particularly adaptable for use in constricted areas where it is impossible to back the vehicle into position for unloading. The body is swung around by hand (the fifth wheel is mounted on rollers) and dumped manually through a combined chain hoisting and movable fulcrum arrangement, shown diagrammatically in Fig. 6A. In operation, the chain *21* which is attached to the arm *22*, is wound up on a drum *23* through a train of gears set in motion with a crank attached at *24*. The arm *22* has a roller at its lower end which travels on a metal track, thus reducing friction to the minimum. The body returns to its normal position by gravity.

A somewhat similar arrangement is shown in Figs. 7 and 7A, though the method of application of the movable fulcrum is quite different. The arm *25* is pivoted to the body and travels on a track on the chassis, the chain *26* being attached at its lower end and wound up on a drum *27* operated through a train of gear wheels by a hand crank attached at *28*. Thus, winding up the chain draws the arm *25* to the rear and hoists the body, which returns to its lowered position by gravity alone.

Operating on the rolling fulcrum principle which permits the application of the greatest power at first, with a gradual diminishing of power as the load is raised into position and less effort is required to raise it, the arrangement depicted in Figs. 8 and 8A is unusual and is different from any of the others. The arm *29* is pivoted to the body and operated by the chain *30*, running over a chain wheel *31*, which is worm-driven from a shaft *32*, driven in turn by spur gears from the propeller shaft. The body is hauled down by reversing the motion of the shaft *32* by means of an idler gear controlled by the driver from his seat.

The mechanism governing the hydraulic hoist shown in Figs. 9 and 9A is operated from a countershaft extended at the front end of the gear set. On this shaft are mounted respectively a chain sprocket and a driving clutch. A lever permits the clutch to slide along the shaft and engage with the sprocket. Alongside the gear set there is a countershaft mounted in ball-bearings from which a rotary oil pump is driven. The pump is connected to the cylinder of the hydraulic ram by means of a suction pipe *33* leading into the top of the cylinder. The oil under pressure forces the piston *34* up until the top of the stroke is reached, at which point a strike valve opens three ports in the piston, allowing the oil to escape freely into the top portion, thereby holding the body at rest. The actual lifting of the body is accomplished through the intermediary of a flexible steel cable *35* passing over two sheaves *36* and under a central third sheave *37*. Thus, for a given lift of the piston the body is raised twice the height. The third sheave acts as a compensating device equalizing the lifting force on both sides of the body. The whole mechanism is firmly braced to the chassis, but in such a manner that it can be detached as a complete unit without disturbing the truck chassis itself.



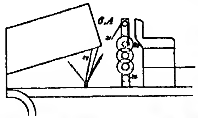
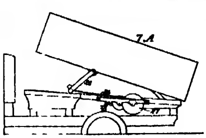


Fig 5A.—Details of Fig 5. Figs. 6 and 6A.—Swiveling dumping body

Fig 7.—Elevating gear employing a sliding fulcrum.



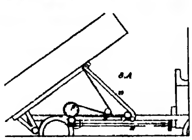


Fig 7A.—Details of sliding fulcrum. Fig. 8A.—The rolling fulcrum.

Horse Trucking Costs Estimated by a Team Owners' Association

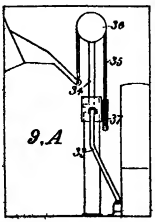
ONE of the problems which the motor truck transportation engineer has to face when he comes to compare motor vehicle with horse transportation costs is the lack of any definite figures on the cost of using horses.

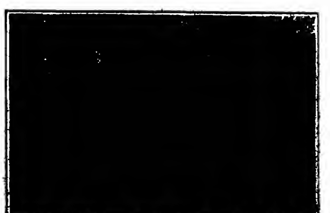
Members of the Team Owners' Association of Boston, which is made up of a hundred or more of the leading men engaged in the trucking business of that city, recently became involved in a discussion over this question, which resulted in the employment of a certified accountant to investigate the subject, and his report was read before a meeting of the association. This report is in part as follows:

"To start with, there are 365 or 366

(Concluded on page 384.)

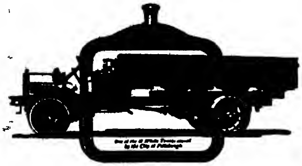
Fig. 8.—The rolling fulcrum varies the leverage as required.





Figs. 9A and 9.—Raising a [illegible] body by hydraulic [illegible]

END DUMP BODIES FOR COMMERCIAL VEHICLES



The Final Choice of the Discriminating Purchaser

After trying out several different types of motor trucks for the past two years, The Atlantic Ice and Coal Corporation, of Atlanta, Georgia, has recently ordered fifteen White Trucks for immediate delivery.

Responsible firms prefer to purchase truck equipment from responsible manufacturers. This is one of the reasons why the final choice of the discriminating purchaser is invariably White.

Another point of importance is the fact that White Owners continue to buy White Trucks. When Whites are used, experimentation ceases.

White Trucks are the most economical trucks to operate.

THE WHITE COMPANY
CLEVELAND
Manufacturers of Gasoline Motor Cars, Trucks and Taxicabs

29 More G. V. Electric Trucks

For the New York Railways Company

The Third Avenue Railway Company received their first G V Emergency Wagon in May, 1911 Today they have in all 8 G. V Trucks.

What is now the New York Railways Company bought their first G. V Truck in November, 1911 On March 25, 1913, they placed their entire order for new electric truck equipment with the General Vehicle Company, Inc

The order calls for the following machines —

- 1 1000 lb. wagon with express type body
- 2 1000 lb. wagons with panel bodies.
- 1 2000 lb. panel money wagon.
- 5 2 ton emergency wagons.
- 14 3½ ton trucks with steel dumping bodies.
- 4 3½ ton trucks with platform and stake bodies.
- 2 5 ton trucks with platform and stake bodies.

This order represents an investment in G V Electrics of over $100,000 00

Over 100 other public utility corporations, including some in Manila and Rio de Janeiro, use G V Electrics and many of these are standardizing on the G. V product. They can safely do so, for money can buy no better

We can offer you **road transportation machinery** proven by 12 years' use

Catalogue 101 on request

GENERAL VEHICLE CO., Inc.
General Office and Factory Long Island City, New York
New York Chicago Boston Philadelphia

Your Week-end, Your Hupmobile And a Breath of Life in the Open

The fleeting Hupmobile—the car that "runs wherever a dog can"—turns at last into Farmer Hoskins' lane

You remember that Day—the one Perfect Golden Day It is given to each of us to Live and Treasure just one such day Dawn was just breaking—a spring day, the Dawn of a New Summer—when you and Billy and Ned and Steve left the drowsy city street and streaked for that Lake.

But Hoskins, Junior, has beaten you to it. He grins through his freckles, holds up his string and then leads you off through the hickory grove to the Enchanted Lake of your Dreams.

Then, when the shadows are dancing through the hickories and the fish stop biting, you pile into the Hupmobile, and wing through the falling evening back to the city—in actual miles very far from the Lake of your Dreams, but in the Hupmobile—very near.

You, who long for freedom now and then from the every-day [illegible] too, with a Hupmobile [illegible] costs are measured. [illegible] family It is [illegible] can [illegible] comfort and [illegible] of costlier price [illegible] give your loved [illegible] with this sturdy [illegible]

[illegible] Mich.

Hupmobile "32" Touring Car, $1000 f. o. b. Detroit

In Canada, $1180 f. o. b. Windsor

[illegible]

Wheelbase, 106 in. Tires, 32x3½ in.

[illegible]

"32" [illegible], $1[illegible] *In Canada, $14[illegible]*
"32" Roadster, $1000 *In Canada, $1180*
"20" H. P. Runabout, $750 *In Canada, $850*

F.O.B. Detroit or Windsor, fully equipped.

[illegible]

United States Standard Motor Truck Tires

are the most easily manipulated tires in the world

Do This

—then This

—then This

— and your Tire is off

GUARANTEED FOR
10,000 Miles of Service
conditional upon this mileage being used in one year

UNITED STATES TIRE COMPANY

days in a calendar year A horse, to take the horse as a unit, must be fed, housed, maintained and cared for during the 365 days, but to get his earning capacity, excepting the unusual occasions of a few Sundays or night work, there should be a deduction of fifty two days for Sundays and 9 for holidays (61 days), leaving 304 effective days. This is actually a reduction of 16.7 per cent or 1/6. Further, for illustration, a large drayage business of just 200 horses must, of course, have from four to six driving horses for the use of managers and foremen in properly directing the work There are spare horses or sick horses, which would bring the total of unproductive horses up to about 20, that is 10 per cent. Now, these driving horses must be fed and cared for, as well as the sick horses, and this takes off 10 per cent more from the 83 1/3 per cent left, which would leave exactly 75 per cent. Therefore, if it costs, as it does at present, $19.87 per month to feed a heavy draught horse, and there are 200 horses in the stable it means an expenditure at present prices for oats, hay and other feed of $3,974, and to get the cost of keeping one draught horse effectively in the street per day, divide by the number of horses, and make an allowance for holidays, and this would be $0.90 per horse per day, from which you must not jump to the conclusion that any one claims a horse actually eats $0.90 worth of feed per day What it actually eats is $0.66 at present prices, and the rest is added as his proportion of that food eaten by the idle horses, the sick horses, and that proportion of the holiday divided up on the working day'

The following table of costs covering both one and two-horse teams was included in the report

	1 horse team	2 horse team
Driver's pay per day	$2.00	$2.50
Feed per working horse day	90	1.80
Rent and stable expenses per horse per day	.31	.62
Shoeing and small repairs per horse per day	19	38
Claims, accidents, tools, etc	15	30
Foremen's and lumpers pro rata	18	36
Other helpers per horse per day	.20	40
Repairs, harness and painting	13	26
Managers' or superintendents salaries per day	10	20
Office rent telephone and clerks	31	62
Miscellaneous, veterinary, etc.	24	48
Fire and accident Insurance	08	16
Depreciation for renewals of horses	.20	40
Total	$5.02	$8.54

In conclusion the accountant says "It would seem from the above figures that any man that thought of letting a truck for $8 per day or less is cheating himself, and if he will look over these twelve items, he will claim, as he owns his stable he does not have to pay stable rent, and as he puts his own time in, perhaps, working fifteen to eighteen hours per day, he is saved managers' salaries, but is that an intelligent way to run a business, and is not the important business of transporting through the streets of a city like Boston millions of dollars' worth of costly goods and the largest amount of wool handled in any city in the world, with the possible exception of Liverpool, worthy of a position that will permit at least a 6 to 10 per cent return on capital actually invested, and a few hours' release from business cares for those employed in this most responsible calling?"

Two Hundred Per Cent Increase in the Motor Truck Industry

THE Commercial Vehicle Committee of the National Association of Automobile Manufacturers has just issued some statistics on the growth of the motor truck industry in 1912, and its probable growth during the present year The output for 1912, as reported by 170 companies, was 21,990 commercial vehicles, as compared with 10,655 reported for the year 1911 by 85 companies, and 10,374 reported for all preceding years combined up to the end of 1910 by the same 85 companies. [illegible]

estimated that 10 per cent of the total production was not reported in 1912 and 25 per cent was not reported in 1911 and previous years. The total output would hence be 24 178 for 1912, as against 13,310 for 1911 and 12,908 for previous years, making a total output up to and including 1912 of 50,420. The estimate for 1913, based on the report of 170 companies, plus 10 per cent, is 50,744 which represents a growth of considerably more than two hundred per cent. The mean average price of all commercial vehicles produced in 1912 was $1 957.37. The average price of gasoline cars was $1,868.95 and of electric vehicles, $2,405.18. The average price of gas trucks in 1911 was $2,070 16, and in all preceding years combined $1,955.70, while the average price of all electric cars in 1911 was $2,759 00, and of all preceding years $3,369 72.

Motor Truck Researches at the Massachusetts Institute of Technology.

To the Editor of the SCIENTIFIC AMERICAN

Remarks by Mr John Ritchie, Jr in the March 29th issue of the SCIENTIFIC AMERICAN have been noted by the writer

We believe that the motor truck researches being conducted by the Massachusetts Institute of Technology are very thorough and sincere but as Mr Ritchie states that the bulk of the support for conducting these experiments and tests was furnished by electrical interests, we are inclined to believe that that was why the electrical figures appear so favorable

We do know that there are over 400 Pierce-Arrow trucks in daily operation in various parts of the country, and none of them costs more per mile to operate than stated in the table published in your February 22nd issue. There are seventy of these trucks under the writer's personal supervision in this vicinity, and they all operate for less cost than mentioned in this table

If the Massachusetts Institute of Technology were experimenting with old trucks or with new inefficient trucks, the high figures they get for gasoline trucks would be accounted for

From the actual work done by Pierce-Arrow trucks in this vicinity, the tire cost per mile averages less than 5 cents.

ROBERT C REIN,
Manager Truck Department,
Harrolds Motor Car Company

Overloading the Motor

By John R. Eustis

THERE is probably no one thing that will send a motor truck to the repair shop quicker than overloading. Over speeding is about equally hard on the vehicle, but a driver can always know when he is exceeding the safe limit in this respect, while overloading is often done unconsciously

The reason for this is that few operators know accurately the weights of the commodities which they transport on their vehicles. When horses were used this knowledge was unnecessary, for the behavior of a team always shows whether the load is too heavy for it.

A motor truck, on the other hand, will move a load a ton or more in excess of its rated capacity without showing the terrific strain to which it is being subjected. This strain will soon tell, however, and frequent trips to the repair shop inevitably follow

To avoid overloading of motor trucks or any other type of commercial vehicle it is necessary to know the weight of each package or unit that is loaded on it. In some cases weighing platforms on which the loaded truck can be run are available, but then the tendency would be to "let her go this time," rather than remove part of the load.

There is, of course, always a margin of safety over the rated capacity of a motor truck, but it is not advisable to take advantage of it, and when unusually rough streets and steep grades are to be encountered, it is best to keep the weight under the rated capacity.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12785) T A P asks Is there any limit to the size a star might have and if so, what fixes this limit? A. The magnitudes of stars were arbitrarily fixed at first. The twenty brightest were called first-magnitude stars the faintest star visible with the eye the sixth At the present time the matter of magnitudes has been settled upon a mathematical basis. The fact was determined by Herschel that a first-magnitude star gave about 100 times as much light as one of the sixth magnitude. Upon this basis the ratio of the light of the several magnitudes has been fixed as the sixth root of 100 so that a sixth-magnitude star is taken as giving a unit of light the fifth-magnitude star gives 2.5 as much and in this way the first-magnitude star gives 100 times as much light as the sixth. This introduces fractional magnitudes, and negative magnitudes, for there are several stars which give more than 100 times as much light as is given by a sixth-magnitude star Aldebaran of Taurus is the only star of the even first-magnitude among the twenty stars formerly rated as of first-magnitude. We add the list of first-magnitude stars from Todd's 'New Astronomy' price $1 45 postpaid.

No.	Mag	Name.
1	−1 4	Sirius
2	−0 8	Canopus*
3.	−0 1	a Centauri*
4	0.1	Capella
5.	0.2	Arcturus
6.	0.2	Vega
7	0.3	Rigel
8.	0 4	Achernar*
9	0.5	Procyon
10.	0 7	b Centauri*
11	0 9	Betelgeuse
12.	0 9	a Crucis*
13.	0 9	Altair
14.	1 0	Aldebaran
15.	1 1	Spica
16.	1 2	Antares
17	1.2	Pollux
18.	1.3	Fomalhaut
19.	1.3	Regulus
20.	1 4	Deneb

*Invisible in middle northern latitudes

The size of a star cannot be determined directly A star may be near and hot, and thus give much light. It may be remote and cool and give little light although very large. When the distance of a star has been found, its size may be estimated on the basis that it is about of the same light-giving power as our sun or some other star

(12786) G S asks I would like to construct a wireless outfit for two different stations, so that we can pass some of our time experimenting Now I have the secondary winding of a spark coil formerly used on an auto. It is in perfect condition as far as I know and I would like to use this as the secondary winding on a transformer on a 110-volt circuit I have tried winding the original coil with as much wire (about No 24 double silk-covered magnet) as I could and get it inside the secondary but it don't work. I can't get enough wire on it, and she heats up. Now I would like to know how much wire to put on my primary (and what size) to give me a 4- or 5-mile sending radius A. Your best way to proceed in making a wireless telegraph outfit is to get Morgan's "Wireless Telegraph Construction for Amateurs,' which we send for $1 50, and in that book you will find the description of every part of the whole apparatus with cuts, sizes, and directions for construction so full and clear that you will save time and money by getting it. We should not advise the use of a telephone secondary for your coil. The wire is too fine and the coil too small for satisfactory service. It would serve to transmit a short distance, but we do not think it can reach 3 to 4 miles. Your primary has quite too fine wire also. No. 14 is probably the size you should use. Nor should you try to put 110 volts directly upon the primary A resistance of lamps is best adapted for controlling the current, and will be cheaper in the end. You require such a guide as Morgan all along the way and with it your own ingenuity will doubtless enable you to make a success of the outfit.

(12787) J M H. asks: Will you please tell me how to preserve leaves of bright color and keep their beauty? We have beautiful foliage plants here in Cuba, and I wish to know how to dry them with their colors. A. The secret of preserving the colors of leaves when dry is in drying them rapidly yet without heat. Heat will shrivel the leaves. Drying slowly will give time for decay to change the color The best method we have found is to use blotting paper to absorb the moisture, and change the papers at least every day. It is better to change twice a day at first, and to use three or four sheets of blotting paper over each layer of leaves. Of course you will have a board on the top, and place a [illegible] press the whole. [illegible] quite dry when they [illegible] [illegible]

NEW BOOKS, ETC.

The Interpretation of Radium Being the substance of six free popular experimental lectures delivered at the University of Glasgow by Frederick Soddy M A, F R S Independent lecturer in physical chemistry and radio-activity in the University of Glasgow With illustrations Third edition revised and enlarged New York G P Putnam's Sons, 1912

The previous editions of Mr Soddy's excellent book on radio-activity have been so fully reviewed in these columns that an extended notice of this third edition is hardly necessary We can only repeat what we have already said i e that the book is a model of straightforward simple writing which is not only popular in style but accurate in expression Mr Soddy has of course included accounts of the new discoveries and developments The thorium series since the technical production of the new radio-active substances mesothorium and radiothorium now have a considerable and growing importance for which reason they are considered at length We are glad to see how cautiously Mr Soddy handles the subject of the transmutation of elements which has been thrust into public notice by extravagant newspaper accounts of Sir William Ramsay's experiments On the whole those who take an interest in the new chemistry and who wish to read a conservative and yet popular account of the modern chemist's achievements in the field of radio-activity will find Mr Soddy's book eminently suited for the purpose.

The Gasoline Engine on the Farm A practical, comprehensive treatise of the construction repair, management and the use of this great farm power, as applied to all farm machinery and the farmer's work indoors and out By Xeno W Putnam 170 illustrations New York The Norman W Henley Publishing Company, 1913 Price, $2 50

The uses for the gas engine are legion It is the mechanical chore boy of the farm the Percy or mechanical man of agriculture It can be and is used in the house in the barn in the field and in the garden There is hardly any place where there is work for a man to do that the gasoline engine cannot be used to advantage On many American farms little engines may be found that vary in size from one and two horse-power to forty and sixty horse-power and that are used for almost every imaginable purpose Just how extensive is this application of engines it is difficult to state with any degree of certainty No accurate statistics are available to show the actual number of farm engines in use but the number must be huge For example in 1911 three companies alone made upward of 100 000 engines ranging in size from two to fifteen horse-power Eighty-seven manufacturers report that they had sold since starting in business 655 000 engines while seventy-six firms reported early in 1912 that their requirements for the year were at least 705 000 engines As nearly as we can determine there are 750 manufacturers of gasoline and oil engines in the United States and fully five hundred of these make a specialty of farm engines Obviously it is time that some book should appear which is devoted to a subject of such vast importance for the term farm machinery to the average man means simply ingenious harvesters reapers and binders Mr Putnam has performed a useful service in meeting what must be a real demand for a complete worker's handbook on the internal combustion motor and its agricultural applications The applications of gasoline engines to farm and domestic work that he reveals are simply amazing We can only wish that Mr Putnam had omitted the rather fulsome praise of his work embodied on the title page

Practical Methods of Sewage Disposal For Residences, Hotels and Institutions By Henry N Ogden, M Am Soc C E, and H Burdett Cleveland, Assoc M Am Soc C E New York John Wiley & Sons, 1912 8vo, 132 pp, illustrated Price, $1 50 net

The work is particularly addressed to householders, and hence dispenses with all unnecessary technical terminology It gives definite practical information as to the construction of a small plant to successfully deal with the sewage from a country house. It does not seek to displace the engineer and the trained man in the handling of larger problems and unusual conditions. Directions are given for building and operating a settling tank preferably cleaned out often enough to prevent septic action from taking place. However open to criticism such tanks may be from distinctly modern and up-to-date standpoints, they are at least preferable to the loose-walled cesspool so widely used Sub-surface irrigation and sewage filters are dealt with in subsequent chapters of the work and the final division is given over to estimates of cost.

English Sects. A History of Nonconformity By W B Selbie, M.A, D D New York Henry Holt & Co, 1912, 16mo, 256 pp Price, 50 cents net.

In fulfillment of the plan of its publishers, the Home University Library seeks to include within its scope every subject of vital and educational interest. This brief history of nonconformity its origin and progress down to the present time, will be welcomed by the many for whom the subject has a real and deep appeal.

Oxy-Acetylene Torch Practice. A book for the men who use the oxy-acetylene welding and cutting torches. By J. E. Springer. New York The

RELENTLESS FRICTION

How it ruins automobile motors. How the remedy must be determined.

WITHOUT lubrication your car could run only about 20 to 30 times its own length

Friction would then stop the power

As oil saves power, it follows that one oil will save more power than another

An important question is

What oil will eliminate the most destructive friction in your motor?

Motors differ. Different cars demand different oils.

Only oil of the very highest lubricating qualities can properly protect the moving parts.

Only oil whose "body," or thickness, is suited to your feed system can properly reach the friction points.

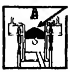
With such an oil, practically your only friction is the friction of oil against metal

You will find this grade of oil indicated, opposite your car, in the chart printed in part on this page

The recommendations in the chart were arrived at after a careful motor-analysis of the cars named. The oil's efficiency has been further proven-out by practical demonstrations

If you use an oil of less correct "body" or of lower lubricating efficiency your motor must pay the penalty

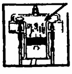
Some of the consequences are pointed out below



Carbon Deposit (excepting that due to faulty carburetion and gasoline combustion) is commonly attributed to the *quality* of the lubricating oil. Quite as often the fault lies with the oil's "*body*."

In some motors a light-bodied oil will work too freely past the piston rings, into the combustion chamber. Lubricating oil itself is a hydro-carbon product. Carbon can never be wholly filtered out. When the oil works freely into the closed combustion chamber carbon deposit is bound to occur

An unnecessary quantity of the oil is consumed. Ignition trouble, and in time, "knocking" of the motor results

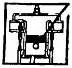


Another common result of faulty lubrication is **scored cylinder walls**

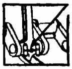
The scoring is generally caused by the oil's low lubricating *quality*

Or it may be caused by too light a "*body*." In that case the oil fails to carry through to the end of the piston stroke

The piston rings then rub directly against the walls. In time they break. Scoring and scratching of the cylinders will result. Hissing of the motor follows

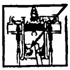


A third result of wrong "*body*" or low lubricating *quality* is **worn wrist-pins**. This trouble causes a dull, metallic knock. In extreme cases the wrist pins break



A fourth result is **worn connecting rod or main bearings**. This unnecessary wear is caused either by the low lubricating *quality* of the oil, or by an oil whose "*body*" is unadapted to the fit of the bearings

The bearings in different motors differ widely. For proper lubrication they require oils of different "*body*."



A fifth common result is **loss of compression and escape of the explosion**

The oil's actual lubricating *quality* plays no part in this loss. The escape is attributable wholly to the oil's incorrect "*body*."

With certain types of piston rings a light bodied oil forms too thin a film around the ring. Loss of compression, escaping explosion, and reduced power result

There is no plain symptom by which this escape can be discovered—other than the lessened power of the motor

TO avoid these troubles you *must* use an oil of the highest lubricating *quality*, and of correct "*body*."

There is only one way to determine the correct "*body*." That is, to carefully analyse the construction of the motor

Any less thorough method can only be a hazardous guess

To meet this problem, each season we carefully analyze the motor construction of every make of automobile

Based on this analysis and on practical experience, we determine the correct oil for each car

The results of these conclusions are compiled in a lubricating chart—printed in part on this page. This chart specifies the correct grade of Gargoyle Mobiloil for your car

The efficiency of the oils recommended has been thoroughly demonstrated in practical use

In sheer lubricating *quality* they stand alone

Oil of the *quality* and "*body*" recommended is an **absolutely** necessary step toward

(1) The greatest horse power efficiency
(2) The smoothest operation
(3) The fewest repair troubles
(4) The lowest operating cost per mile
(5) The longest life to your motor
(6) The greatest second hand value

WE have here discussed lubrication with considerable assurance. You may wish to know more about the basis for this certainty

We will speak plainly. Lubrication with us is both a business and a profession

Throughout the world the lubricating counsel of the Vacuum Oil Company is sought by engineers who must meet the most rigid efficiency standards

We are depended upon to determine the lubricating requirements and to supply the oils that meet them

Our clientele includes thousands of manufacturing plants—located in practically every civilized country

We supply the floating armament of the world's leading naval powers.

We supply practically all of the ocean greyhounds

We supply the aeroplane fleets of the leading military powers

Outside of the home field we supply seventy foreign automobile manufacturers

---

OUR chart of recommendations represents our professional advice

If you use an oil of less correct "body" or of lower lubricating quality than that recommended, unnecessary friction, unnecessary carbon deposit, loss of power, and ultimate damage must result

In buying Gargoyle Mobiloil from dealers it is safest to purchase a full barrel, half-barrel or a sealed five-gallon, or one gallon can. Make certain that the name and our red Gargoyle appear on the container

A booklet, containing our complete chart and points on lubrication, will be mailed on request

Correct Lubrication

[illegible]

GARGOYLE

Mobiloil

A grade for each type of motor

The various grades of Gargoyle Mobiloil, refined and filtered to remove free carbon, are

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "D"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

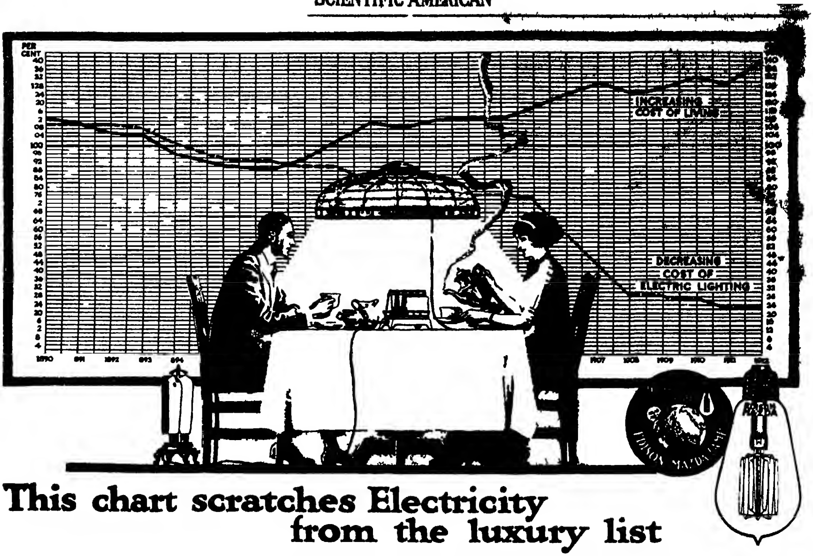
They can be secured from all reliable garages, auto supply stores and others who supply lubricants

VACUUM OIL COMPANY, Rochester, U. S. A.

BRANCHES:

New York	Boston	Detroit	Chicago	Philadelphia	Indianapolis
29 Broadway	49 Federal St.	Ford Bldg.	Fisher Bldg.	4th & Chestnut Sts.	[illegible]

Distributing warehouses in the principal cities of the world



This chart scratches Electricity from the luxury list

Electricity and electrical comforts—once called a luxury—are becoming a necessity in the average home.

And while the climbing cost of other necessities is putting them in the luxury class the falling cost of electric lighting is making it easier and easier for us all to afford it.

Look at the Chart—it is based on Government figures.

Twenty five years ago electric light cost ten times as much as it does today. Seven years ago it cost three times as much as it does today.

All this has been effected by the progress and inventiveness of electrical manufacturers and by the enterprise and improved service of electric lighting companies.

One thing alone—the development of the tungsten filament as used in EDISON MAZDA LAMPS—has subtracted *two thirds* from the former cost of electric lighting. Still another economy is effected by Holophane Reflectors, which *avoid waste* of light by scientifically directing it to where it will be most *useful*.

Edison Mazda Lamps give you *three times* as much light as old-style carbon lamps from the same amount of current. Put them in your home and you can have as much light—and even *more*—than old style carbon lamps give you and *still* save enough current to operate some of the delightfully convenient electric devices shown below.

The Guarantee of Excellence on Goods Electrical

Trade Mark

Electric Wiring Costs Less, Too

You will be surprised to find how little it now costs to equip your home for all these electrical comforts. The walls will not be marred. Your nearest electrical dealer or your lighting company will direct you to a good electrical contractor. Ask them also to show you the various sizes of Edison Mazda Lamps and the many electrical conveniences for the home, bearing the G-E trade mark.

GENERAL ELECTRIC COMPANY

Sales Offices in all Large Cities **The largest Electrical Manufacturer in the world** Agencies Everywhere

SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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THE INTRACTABLE MISSOURI MISSISSIPPI SYSTEM.—[See page 396.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short and the facts authentic the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly the world's progress in scientific knowledge and industrial achievement.

The Human Factor in Safe Transportation

NOTWITHSTANDING the many excellent devices that are being provided to secure safety on American railways and the improved conditions of maintenance of track and roadbed, as well as the gradual extension of block signals and other protective appliances, there seems to be a very marked increase in the number of railway accidents as years go on. In part this can be explained. New conditions of operation such as increased speeds and weights, present new problems, and in many cases an attempt is being made to carry on such traffic over tracks where rails and roadway are not always adequate.

But there is one important respect in which there has been little progress, namely the responsibility of the individual employee. To-day it is the human factor that is most engrossing in any discussion of safety on American railway lines. The deficiencies of the human being and especially direct personal responsibility have been established in many collisions and derailments, and in numberless minor accidents. This has been realized by operating officials. By them the question is often considered one of discipline only in which their efforts have been weakened by the interference of labor organizations and controversies that seemed merely questions of discipline. But it is now realized that by stimulating individual interest and responsibility on the part of the employees, railway operation can be made safer and traffic can be carried on by the companies themselves more economically and expeditiously.

Indeed, the matter has a distinct economic bearing. Payments made on account of injuries to persons during 1911 aggregated $25,070,747 or 0.940 per cent of the gross earnings for that year and for loss and damage to property $33,078,718, or 1.238 per cent of the gross earnings making a grand total of nearly $60,000,000 or 2.10 per cent of the gross earnings. This stands for gross waste and economic inefficiency and the further investigation is made along these lines the more is this apparent. With or without costly damage suits the railway may in part compensate the sufferers, or by accident insurance or benefit associations the burden may be distributed. In the end it is the public that pays either in diminished earnings and dividends, increased transportation charges, or increased premiums or assessments. Furthermore, to the railway itself the loss of life of a capable employee is at least a temporary dislocation of the machinery of transportation, requiring readjustment that may involve more or less time and expense. As in other industries skilled railway employees are no less an asset than material equipment and they should be conserved with even greater care.

The problem of safety resolves itself into the training of efficient employees and their conservation when once trained. Toward realizing this end there has been within a few years, a distinct tendency toward improvement manifested by a spirit of co-operation between operating officials and employees, and a study by the latter of conditions that will secure greater safety.

It has been brought to the attention of the employees with blunt force that they, rather than the presidents, superintendents and other officials, were the ones to suffer in accidents, that while stockholders might pay, it was the men who were killed and their families who were left in straitened circumstances, that the railroads formulated rules and operating conditions to be observed, and that under no circumstances whatever for real or fancied advantage to the company did they desire any chances taken that might cause the slightest possible mishap. It was shown to the railway employees that most of the accidents on railroads were due to their carelessness, disobedience of orders or rules, and negligence.

For example, such trivial matters as projecting nails on platforms, or more particularly on broken cleats from freight cars thrown along the track, are annually responsible for a large number of serious injuries to railway men, and the slightest amount of caution in this respect would save many thousands of dollars loss in wages, not to mention suffering and serious injury. Again, failure properly to pile ties, lumber and other material, to close gates, to remove objects in train yards over which a freight brakeman might stumble in the dark, to illuminate the interior of engine houses properly, and the lack of observance of a thousand other points of good house-keeping and maintenance, are responsible for a list of casualties that is striking in its aggregate. But such misfortunes it may be urged are small and bear little relation to the large wrecks in which a score of passengers may be killed or injured. The same condition holds in the direct problems of operation. The trainman may not take the trouble to go back far enough to protect the rear end of his train, the engineer may think he can make time by taking track he is not entitled to, the track foreman may consider a certain section of line with imperfect ties or poor surfacing will answer, while maintenance-of-way officials may consider short cross-overs safe, though realizing the speed of the regulation will be exceeded in passing them. In other words, if the employee is urged to see and remove the projecting nail on the platform, increased safety for him and his fellows is provided, if the brakeman will go back sufficiently to protect the rear end, whether it means a longer walk or delay of the train, until the engineer whistles to call him back, the lives of passengers and employees alike are safeguarded, if the track master will avoid unsafe cross-overs at speeds which he knows will be used, there will be a corresponding gain in the safety of the system.

Obviously this is more than a matter of discipline. If the personal interest of each employee can be aroused, then a great step forward is taken. That this can be done and has been done is shown by the improved record of a number of roads where so-called safety committee organizations have been established. These safety committees are formed of representatives of each class of operatives and certain operating officials. They carry on a campaign of education and inspection, calling attention to the rules and insisting on their strict obedience, urging the employees to report any and all conditions that are in any way dangerous, and to suggest means for safer and better operation. They also urge the employees to eliminate from the service those whose conduct is likely to produce loss of life or injury to their fellow workmen. Such safety committees are now organized on lines representing over half of the entire mileage in the United States and they have received the most enthusiastic commendation of the railway authorities, as well as of the Interstate Commerce Commission.

Another Mad Patent Bill

EXCEPT the tariff and the currency, no subject seems so attractive to the legislative tinker as that of patents. The latest bill which seeks to improve our patent system springs from the fertile brain of Mr. Stephens of Texas. Its object is to require citizens of foreign countries who may apply for copyright registration or for letters patent in the United States to pay the same fees and to be subject here to the patent and copyright laws and regulations of their own government.

Apparently the practice of law is not complicated enough for Mr. Stephens. He would require patent lawyers to follow not only the intricacies of our own statutes, but to acquire an intimate knowledge of all foreign patent practice as well. The judges of our federal courts would have to interpret foreign patent laws and to apply them in this country, although they have difficulty enough in interpreting and applying our own. The Patent Office would be required to keep an elaborate set of books in order to collect taxes and to enforce other burdensome regulations.

Fortunately this spring madness is not likely to be taken very seriously. Inventors have reason to be thankful that tariff reform is just now engrossing legislative attention.

Solving New York's Pier Problem With the Model Basin and the Moving Picture

THE pier problem of the North River has vexed for some years both the municipal dock experts and the army engineers. Both bodies have taken opposite views as to the propriety and wisdom of lengthening the berthing spaces for great trans-atlantic express steamers. New York had hardly more than finished a group of splendid piers ere the fact was discovered that none of them was long enough for the "Olympic" or for her sister ship, which was to follow, the "Titanic." When promised that piers of suitable dimensions would be built elsewhere on the river, the Secretary of War granted permission for the temporary extension of two of the new docks in the Chelsea section facing Castle Point, on the New Jersey shore.

Since then, the dock authorities of the port and other municipal heads have not agreed where the proposed piers should be built, and the time allowed by the Secretary of War for the continuance of the temporary extensions referred to has about come to an end. What has appeared to be a critical stage in the situation has recently been relieved by the announcement that the city of New York is now ready to start work on new piers. With that understanding, the War Department has permitted the temporary extensions to remain a while longer.

The present Chelsea piers bound on one side the narrowest section of the North River, and tidal conditions have been radically changed there in the course of the last few decades by encroachments which have tended greatly to increase the force of the currents. The dock authorities of New York have held that the 100-foot temporary extensions to two of the piers could be maintained without adding to the difficulties of river traffic. The army engineers have maintained otherwise. At this stage of the controversy the Chief of Engineers of the United States Army turned the puzzle over to Naval Constructor D. W. Taylor, U. S. N.

That distinguished authority looked upon the problem largely as a development of the phenomena of suction between ships, and he arranged the basin to represent on a reduced scale the flanking shores of the river with piers of suitable proportions. He sought to determine the suctional influence of a great liner approaching and leaving her dock, both upon river traffic and upon other vessels lying at their piers. In order to make records of all of the disturbing influences created by express steamers ranging in size up to a thousand feet in length, moving picture cameras were employed to catch every movement. Data have been obtained of the utmost value, and the problem of further extending the Chelsea docks has been thus disposed of. What would have continued to be a subject of discussion has been helpfully and suggestively settled at a very moderate cost.

Apart from its local character, the manner in which this question has been brought to a focus and analyzed through the medium of the model basin has a nation-wide significance. Encroachments upon the tidal basins of many of our ports and the immediate demands of commerce have caused "improvements" to be made which, later on, may lead to troublesome conditions. Just as current velocities in some parts of New York harbor to-day are eighty-odd per cent greater than they were years ago. These changes add to the difficulties of river traffic and the cost of all towing that must be done against the sweep of the tide. Piers, of course, of suitable proportions must be built for ocean liners as they grow, but they should be placed where they are least likely to disturb the regimen of the stream seriously. When these questions arise hereafter the model basin will be able to guide us more intelligently and will safeguard us against mistakes which may hamper harbor shipping in the years to come.

Reliability Requirements and the Cost of Electric Power

MANY factors enter into the economics of electric power production. For the best economy it is, of course, desirable that the load be distributed as evenly as possible over the twenty-four hours of the day. Hence the low charges for electrical energy during the daylight hours, in plants whose main output is spent for lighting purposes. But there are other factors whose influence is more difficult to gage in actual figures. Thus Dr. Steinmetz points out that the cost of power depends among other things upon the requirement of reliability and continuity of service, a requirement which varies greatly in importance from case to case.

A breakdown, even of a few moments, in the electric power plant which supplies a large city with current for lighting, running elevators and so forth, will not only cause great inconvenience and annoyance, but may, in a crowded theater for example, bring panic and disaster in its train. The case is somewhat different as regards the power supply to factories, railways and similar institutions. Here a few minutes' breakdown is no doubt a cause of loss, but not comparable in its results with a failure extending over twenty-four hours, say. Then again, in certain cases a shut-down of even a fraction of a minute may mean great loss. If the current is cut off the furnace in certain electro-chemical operations, even for a quarter of a minute, the whole charge may be lost, and the furnace itself may be destroyed.

Where such guarantee of reliability is required, naturally the cost incurred in providing for it must enter into the price of power, a [illegible] which is not always [illegible] by the formula.

Engineering

Gustav Wilhelm Wolff, founder of the shipbuilding firm of Harland & Wolff, Belfast, died on the 17th of April at the age of 79. His firm opened its yards in 1860. Mr. Wolff designed the original White Star ships. The "Titanic" and the "Oceanic" were built by this firm.

The Iceberg Patrol.—In conjunction with the British steamship "Scotia," the revenue cutter "Seneca" is patrolling the transatlantic steamship lanes in search of icebergs and other menaces to oceanic travel. The revenue cutter carries a powerful wireless set with which it is warning approaching passenger vessels of the presence of icebergs.

The "Aquitania," the latest giant liner of the Cunard Company, was launched April 21st on the Clyde. The length of this vessel is 901 feet, breadth 97 feet, depth from keel to boat deck 92 feet 6 inches, and gross tonnage 47,000 tons. Her estimated speed is 23 knots. There will be accommodations for 3,200 passengers with a crew of nearly 1,000. A description of this vessel appeared in the SCIENTIFIC AMERICAN SUPPLEMENT of April 26th.

Progress on the Panama Canal.—On April 1st there remained only about eight thousand linear feet of the Culebra cut that had not yet reached grade in some parts. At the present rate of progress it is estimated that 5,500,000 cubic yards of material may be removed by October 1st. Work with steam shovels will then cease and dredges will be used to remove the two or three million cubic yards remaining. This amount will no doubt be increased by slides. A record for steam-shovel output was made on March 29th, when five steam shovels removed 11,343 cubic yards of material in a single day from the Cucaracha slide.

Unusual Type of Diesel Engine.—Probably bringing the true Diesel engine for self-propelled road vehicles at least one step nearer, J. Bukh, a Danish inventor, has developed an engine of that type in which the compression is variable and which dispenses with the usual compressed air starting apparatus. In Bukh's engine, there is an auxiliary combustion chamber in the cylinder head controlled by a valve. When starting the valve is opened, thus lowering the compression to approximately that of the ordinary internal-combustion engine, and after the engine has taken up its cycle of operations the valve is closed, when the engine then operates on the Diesel principle.

Italy to Promote Agricultural Tractor Competition.—Now that so much attention is being given motor-propelled farm apparatus, additional interest centers in a competition for agricultural tractors which is to be promoted by the Italian Touring Club, the Italian Federation of Agricultural Associations and other prominent bodies. The Italian Touring Club is the moving spirit in the venture and is located at Via Monte Napoleone, Italy. The events will take place at Parma and will include an international field competition of motor apparatus for the cultivation of land, a national competition for internal-combustion motors and an international competition for internal-combustion crude oil agricultural engines. Entries should be addressed to the Italian Touring Club.

Rotterdam's New Harbor, which is rapidly nearing completion, will be the largest artificial harbor in the world, the water having covered 766 acres. It was in 1907 that the municipality voted its construction, and work was at once commenced on those portions lying without or beyond the Maas dyke. As for the polder land within the dykes, a law of expropriation had to be passed. As soon as that was passed—in 1911—work could be commenced there as well. Meanwhile in the outer dyke portion a basin of 125 acres, of which 106 acres is 28 feet deep was completed and at once taken into use. Indeed, as early as 1908 the first sea-steamer moored there. So, as soon as the expropriation had taken place, work was commenced on the portion within or behind the dyke. This proceeded but slowly at first, for it had to be done "on the dry," as they say there, by excavation, which can only remove a maximum of 45,000 cubic yards in a week (while dredging machines can in the same time remove 85,000 cubic yards). But there was no other way, for if the water had been let in by piercing the dyke, all the low-lying land behind it would have been flooded, so the portion of the polder destined for the harbor, some 230 acres, had first to be inclosed by a dyke that joined to the existing Maas dyke at each end. This new dyke is 16 feet high and about 7,900 feet long. Behind it is a raised roadway 33 feet wide, where a railway is planned to run right along the harbor. About 1,400,000 cubic yards of earth went toward constructing the dyke and road, the earth being excavated from the harbor. The last excavator stopped work in October last and a dredging machine was at once set to work to dredge away the portion of the Maas dyke that still separated the outer from the inner portion, thus letting the water into the new basin. Since then work has proceeded rapidly. When completed the harbor will have a depth of [illegible] feet.

Science

An Anti-earthquake Construction Exposition will probably be held at Messina, Italy, in the autumn of 1913, in conjunction with the sessions of the Congress of Civil Engineers.

Amundsen Financed by Americans.—The National Geographic Society has granted $20,000 in cash to Capt. Roahl Amundsen for his coming expedition to the Arctic regions. Thus the financial success of the project is assured. The Norwegian Geographic Society has offered to raise $40,000.

The Upper Irawadi.—A British expedition, under official auspices, is now engaged in the difficult and dangerous task of exploring the little-known territory about the head-waters of the Irawadi, the great river of Burma. The expedition consists of two parties, one under Mr. J. Barnard, and one under Mr. F. V. Clerk, and will be in the field for about 5 months.

Wood Sugar.—The making of grain or ethyl alcohol from sawdust has been so restricted in England by absurd regulations that the industry is seriously crippled. Classen's process made use of the fact that sawdust digested with a weak solution of sulphurous acid under six or seven atmospheres pressure is converted into sugars with a yield of about twenty-five per cent. Four fifths of this can be fermented into alcohol if desired, but now the English are extracting this crude wood sugar and using it as stock food. It cannot be crystallized for commercial table use.

Dried Potatoes as Cattle Food.—Germany is evolving an ever-increasing number of potato products and thus rapidly solving the problem of disposing of the once enormous surplus of this crop. A number of establishments in that country are now turning out quantities of dried potatoes, in various forms for use in feeding cattle. According to a recent consular report, dried potatoes do not cause the forms of sickness that result from a diet of raw potatoes. Moreover, raw potatoes can be preserved for only a limited time, while to boil the potatoes would impose upon the stock-raiser more expense than the circumstances justify. Official tests have proved that the one third of strengthening food generally given to horses in the form of grain could be replaced by dried potatoes and such animals would be kept in excellent condition.

Dielectrifying Silk by Radium Salts.—During the process of combing silk the skeins become highly electrified and it has been the habit to remedy this condition by maintaining a damp atmosphere in the workroom. This is, however, prejudicial to the health of the workers, and may be avoided, according to a writer in *Cosmos*, by the very simple expedient of placing near each loom a receptacle containing a weak solution of a radium salt. The electric charges issuing from the radium neutralize the electrostatic charge which the threads of silk acquire by reason of friction. A similar problem in the manufacture of linen has been solved somewhat differently by MM. Paillet, Ducretet and Roger. To dielectrify linen during the spinning process, or the stretching of the threads, they employ the sparks of high-frequency currents, which are, as is well known, non-injurious to the human body.

Disinfecting Linen.—In cases of measles, scarlet fever and other infectious diseases it is highly important that the linen used by the patient should be disinfected at once, especially when the laundry work is done outside the home, as is usual in most modern cities. Otherwise it may become a source of danger to the persons handling it, or may infect the hampers in which it is stored or carried. *Les Annales* suggests two or three simple but effective methods to accomplish this purpose. One of the best is to moisten with a weak solution of copper sulphate, the "one twentieth." This sterilizes without injuring, and the faint blue tinge left is removed by washing. Calcium chloride is likewise effective but it smells strongly of chlorine, which is often objectionable. In the Pasteur Hospital a 2 per cent solution of cresylene is employed to sprinkle the objects. This completely sterilises in 24 hours.

Welded Aluminium Joints.—A German inventor, Otto Nicolai of Bonn, claims to have found an excellent method for detecting the soundness of welded joints in aluminium wire or manufactured articles, especially vessels and the like. To see whether the joint is in good condition, all that is needed is to put it in water, and if bubbles of gas are seen within the space of forty-eight hours, this is a sign that the welding was badly done, and in such case the sample will be sure to break down sooner or later. The gas given off here is hydrogen. He claims that a bad joint will give out by a 14 days' immersion in water, as the metal disaggregates, while in the air the time is considerably longer, six months or more before breaking down. Damp air causes the failure to take place in less time, as may be expected. For domestic utensils there is great danger of the aluminium wearing off and taking the shape of cutting scales of metal, and when these enter the digestive organs they are likely to do much damage.

Aeronautics

A New Balloon Duration Record.—On March 23rd, Rene Rumpelmayer made a long distance flight in a free balloon from Paris to a point near Kharkov, Russia. He traveled a distance of 2,400 kilometers (about 1,492 miles). Rumpelmayer was pilot of the balloon "Picardie," which won the last Gordon-Bennett race. In that race he made a record of about 1,361 miles.

A Flight from Dover to Cologne with a Passenger.—On the 17th ult. Gustav Hamel made a record flight with a passenger from Dover, England, to Cologne, Germany—a distance of 245 miles in 258 minutes. Five countries were flown over and five showers were encountered besides a hailstorm which was met in mid-channel and successfully flown through. This was the twelfth crossing of the Channel by Hamel, who uses a Blériot monoplane. The flight demonstrated the immense value of the aeroplane in traveling quickly from country to country without let or hindrance.

Life Saving Device for Aeroplanes.—Joseph M. Conner of New York and Elmer R. Conner of Port Richmond, N. Y., in a patent No. 1,057,221, provide for combining with an aeroplane a parachute and a harness which secures the parachute while folded directly to the body of the aeronaut. There is an independent belt adapted for attachment to the body, and cords connect the belt and parachute and there is a cord which directly connects the peak of the parachute and the aeroplane. This cord operates first to position the parachute over the body should the body fall, and to break after the weight of the body is placed upon the parachute and after the parachute has been positioned over the body.

Flying in Winter.—The severe cold which prevails in Russia and the resulting atmospheric conditions make aeroplane flights somewhat out of the ordinary in that country. In spite of the hard weather the Imperial Aero Club is turning out many very good pilots at its Aeronautic School which has large aerodrome grounds devoted to this purpose in the neighborhood of St. Petersburg. We may mention a flight made by Capt. Vatsiuk, the chief of the school not long since. Along with Lieut. Golostov he flew as far as Schuvalovo in Finland and back without alighting. At the aerodrome there are often very hard snowstorms but the pilots still keep up their flights, even though they are much shaken up and also blinded by the snow which covers them entirely. The motor needs to be looked after constantly, as the oil thickens up in the great cold. This appears to be the first time in Europe that aeroplane flights have been made in such great cold, so that the fact deserves mentioning and is another proof that the aeroplane will stand nearly all weathers.

A New Height Record.—A month and a half ago a new height record of 6 000 meters was made by M. Perreyon, chief pilot of the Blériot school with a Blériot monoplane fitted with a 100 horse-power Gnome motor. Rising from the aviation field at Buc at 11 25 A. M., Perreyon rounded the field in great circles steadily rising until he had reached a height of 5,700 meters (18 700 feet) after which he flew in a nearly straight line in his endeavor to reach a still greater height. After an ascent lasting about an hour he finally reached 6,000 meters (19,685 feet). The air was so clear that he could see as far as Rouen a distance of 75 miles and he was also visible from the ground throughout the whole of his flight. The 100 liters of oxygen which he carried gave out and so he was obliged to descend at once. He reached the ground in 12 minutes from this tremendous height. He was not troubled with dizziness, as he inhaled oxygen—a thing which none of the other aviators have done who have flown to such a great height. The former record of 5,610 meters (18 405 feet) made by Garros in Tunis on December 11th last, was beaten by a wide margin.

Successful Test of the Gyroscopic Control for Aeroplanes.—On March 23rd at San Diego, Cal., Lieutenant Harold Geiger and Lawrence Sperry, son of the inventor of the gyroscopic compass and of the gyroscope for stabilizing ships, both of which inventions are at present being widely used in our navy, made a preliminary test flight of thirty-five minutes duration in a Curtiss flying boat equipped with Mr. Elmer A. Sperry's new gyroscopic control for aeroplanes. The flight was successful in every way. Experiments are still being continued, and the final test is to be a deliberate attempt to upset the machine while flying over the bay. This will be a Government test, and if it is carried out successfully, the Sperry gyroscopic control will probably be fitted to all Government aeroplanes. We have already noted in these columns that this control consists of a small gyroscope weighing but 2¼ pounds, which operates the warping by means of a compressed air motor the valves of which the gyroscope controls. We understand that Count Zeppelin, in Germany, has also just brought out a successful gyroscopic control for aeroplanes, and applied it to a monoplane of his invention. In this case two large gyroscopes are used to operate the ailerons and the elevator.

Women beheading the sardines and packing them in boxes

Sardines in racks mounted on carriages in the drying room

The French Sardine Industry

By Jacques Boyer

When you purchase a box of sardines or when you open it and devour its savory contents do you ever think how many hands it passed through before it reached yours? The little silvery fishes have been subjected to a long series of operations by the fishermen who extricated them from the meshes of their nets the women who cleaned them cooked them and immersed them in a bath of oil the tinsmiths who sealed the boxes and a supplementary host of packers carriers and wholesale and retail dealers

When the fishing boats arrive at their home port the sardines are taken to the factory where they are beheaded disemboweled and thrown into vats of brine in which they remain from 15 to 45 minutes according to their size On their removal from the brine they are laid on grids which in fine weather are carried to an open drying yard and in bad weather are placed in racks mounted on carriages which are placed in chambers traversed by a current of hot air

When the sardines are dry the grids are taken to the kitchen where they are plunged into huge vessels of boiling oil This operation is watched by women who take care to remove the sardines before their flesh has been heated to excess

After the sardines have cooled they are deprived of their tails and packed in tin boxes by women seated at long tables The boxes are classed as wholes halves and quarters The quarter box contains 8 or 10 sardines and is the most familiar size Sometimes pimento sliced lemons and pickles and other condiments are put in the bottom of the box

The filled boxes are placed on large trays and carried to the oiling room where the voids are quickly filled with oil flowing from a row of taps which the operator controls with one hand while with the other she brings each box in turn under a stream of oil

The boxes are sealed either by soldering or by folding and pinching the edges In the former case the soldering iron is continuously heated by a blow pipe as it passes along the edge of the box which is clamped to a turn table A single blower furnishes the air blast for fifty or sixty flames tended by as many men In the newer factories soldering has been replaced by the more rapid and more hygienic operation of folding and pinching which is performed by special machines so perfectly that the lid is hermetically joined to the box

The sealed boxes are sterilized at a high temperature in autoclaves and are then rolled in sawdust to remove oil and other impurities from their exterior

A curious and important fact in the biology of the sardine is the suddenness with which these little fishes appear in great numbers and subsequently vanish probably in consequence of changes in oceanic conditions According to M Charles Rabot sardines appear in dense schools wherever they find the most favorable degrees of temperature and salinity and disappear as soon as the water has been replaced by a current of different character Unfortunately we know nothing of the physical conditions which the sardine seeks or of the movement of various strata of water along the coast We do not know whether the sardine prefers warm or cool water very salt or moderately salt water nor do we know the temperature and salinity of the sea at different seasons depths and distances from land

In Brittany sardines are caught with a vertical net from 1000 to 1 300 feet long and 26 to 41 feet deep which is supported by corks fastened to its upper border and is attached to the stern of the boat by a cord several yards long As the boat moves slowly against the current the sardines are lured to the net by salted cod thrown on the water The net is made of thread so fine that it is almost invisible and the meshes are of such dimensions that the sardines thrust their heads through them and are caught by the gills A net raised after a few minutes trawling sometimes yields several thousand sardines.

Filling the boxes with oil flowing from a row of taps

This simple and time-honored device gives good results in the hands of the Breton fishermen but their rivals of the Gulf of Gascony and the Atlantic coast of Spain and Portugal prefer the circular seine which is made by completely surrounding a whole school of fish with a vertical net and then drawing the bottom of the net together by means of a draw string The great bag thus formed is gradually contracted by hauling in and the imprisoned sardines are removed by means of landing nets.

Parboiling the sardines in oil before boxing them.

The circular seine is very effective but its employment on the Breton coast is hardly practicable as was proved by experiment seven years ago The French packers nevertheless would like to have it adopted in order to increase the catch Some experts recommend the Guezennec net a floating cage of netting open in front and on top which is towed behind the boat and entraps the sardines as it advances. When the catch is deemed sufficient both openings are closed by drawing cords The top is then reopened and the sardines are removed with landing nets

The French fishermen however, fear that an increase in the catch will lower the price, and they are reluctant to adopt any improved device; although the packers require cheap raw material in order to meet foreign competition, particularly that of Spain and Portugal, which annually throw about 1,800,000 cases of sardines upon the market. The problem, therefore, is a difficult one, and its satisfactory solution will require many concessions from both sides, before this important industry is safe from the demands of fishermen, tinsmiths and packers.

Workmen sealing sardine boxes by soldering.

Right of way, showing joints after eighteen months wear

The "Cleveland Flyer" stopped by the automatic system

A Safety Automatic Train Stop

FOR the past year there has been under test on a five mile stretch of the Pennsylvania Railroad just outside of Pittsburgh an automatic train stop system which possesses many points of considerable interest. As pointed out in the article entitled "A Successful Automatic Train Stop" in the SCIENTIFIC AMERICAN of January 18th last, chief among the requisites of the successful system are that it be entirely on the closed circuit principle, that it be included in the circuit of the ordinary automatic block signals and that any failure of circuits or mechanism cause it to assume the stop position. The present system conforms to all these requirements and in addition claims as further advantages that it requires no appliances on the roadway which might be damaged by rolling stock or that might be affected by sleet or snow, and requires no appliance on the engine which might be carried away by a projection from the roadway. Another important advantage it offers is that it can be made inoperative below certain speeds, or it will release the brakes when the speed has been reduced to a certain value, making it unnecessary to come to a full stop before proceeding. Thus the engineer is allowed to use his discretion in passing a danger signal so long as he moves slowly enough to come to a dead stop the instant the real danger presents itself to him. It is well known that block signals are sometimes thrown out of order by lightning and any disarrangement of the system will result in the showing of danger signals. Under such conditions it is a decided advantage for the engineer to proceed even against the signals, provided he maintains a cautious and safe pace. It is often considered desirable to have a record made of a stop in order to disclose a lapse on the part of the engineer in running past a danger signal. In the present system such a record may be made not only of the full stop but in case there is no stop of the speed at which the train passed the signal. These adjuncts, however, are not shown in the accompanying drawings of the system.

The apparatus carried by the train is mounted in the tender. The locomotive is insulated from the trucks and rear coupler of the tender so that the circuit of the train apparatus is completed through the rails. As illustrated in Fig. 1 the locomotive is indicated as L, the trucks of the tender at TT and the rear coupler of the tender as C.

The apparatus comprises a low voltage battery EB adapted to energize a magnet valve MV operating a brake valve BV. In the circuit of the magnet valve is a relay valve R which is energized by current coming through its own contact, so that if the circuit is once broken the relay must be re-energized through some other contact which is provided by cut off valve CV or speedometer S. As a means of indicating whether the apparatus is under proper control the lamp BL is provided on the locomotive together with the key K. The cut-out valve CV is normally held open by a spiral spring and when open furnishes free passage for air from the train line to the brake valve BV and closes contact for electric lamp BL. When the valve is partly closed it closes contact for re-energizing the relay R. The spiral spring prevents its being left in this position. When the valve is fully closed it locks itself, breaks contact for the light BL and cuts off the brake valve BV from the train line.

The operation of the stop apparatus is accomplished as will be explained below by the introduction of a current of opposite polarity through the system from the track which will neutralize the energy of the relay R, permitting the contact point to drop and break the circuit. If desired the valve CV may be located in some place accessible only from the ground, making it impossible to re-energize the relay R until the train has come to a full stop. The speedometer S is provided with contacts that are closed at any speed desired so that a stop can be avoided if the speed is low, provided the engineer closes the circuit of the speedometer by depressing the key K. He may also use this means of releasing the brake when the speed has been sufficiently reduced.

As the operation depends on the integrity of the insulation between the tender and its truck, it is necessary to provide a leakage detector for this insulation. This is accomplished by making the insulation in two sheets FI with a steel plate HP between. The steel plate is made a part of the circuit of the engine relay and is so placed that any leakage through the insulation will rob the relay R and cause it to open. Since the rail between engine and tender is part of the engine circuit any breakage in both rails at the same time will de-energize relay R and apply the brakes unless some other path be provided for the engine current.

At any location such as a block signal where it is desired to control the engine, insulated joints IJ and IJ (Fig. 3) are placed directly opposite in the track, and track apparatus is provided to make this path if the track ahead is safe but to break the path or place in it an obstacle if the track is unsafe.

The track apparatus at each signal consists of a track relay G and insulated joints IJ and IJ as used at present automatic block signals, a high resistance line relay J, a detector relay F and a low voltage battery CB. The relay J is energized by the same battery SB used for operating the automatic signals and is controlled by track relay G at signal ahead. Two of the contacts of relay J serve as a reversing switch controlling the relation of battery CB to the engine battery EB. In order to be certain of the insulation of the insulated joints a means of detecting a break-down is provided in the relay F, which is normally de-energized and controls track relay G through a back contact, but if the insulation of the joints should decrease, current leaking across will energize relay F and thus de-energize relay G and relay J at the signal

Instrument box carried by the tender

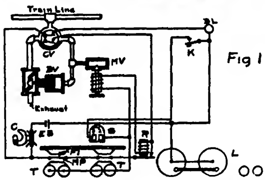


Fig. 1.—Diagram of engine apparatus in normal running condition

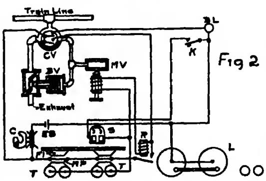


Fig. 2.—Diagram of engine apparatus when entering an occupied block

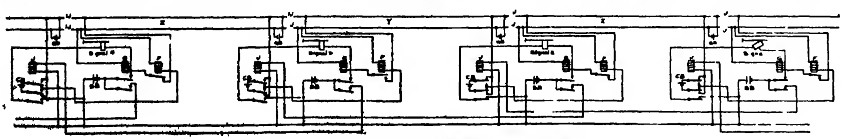


Fig. 3.—Diagram of the track circuits showing an occupied block

in the rear Battery CB is constantly in series with relay F across joints JJ and JJ so that any leakage of current will cause relay F to pick up and to open relay F at signal behind. The local circuit through battery CB and relay F around the insulated joints serves not only as a detector of the joints but also as a path around the joints for engine current in case the track should be safe for the passage of the train. In case the track is unsafe relay F will be opened and although battery CB is still connected to the rails ready to detect the joints its polarity is reversed in relation to engine battery EB so that if an engine should attempt to pass at this time its relay R would be opened and the brakes applied. Battery CB is placed in the loop circuit in order to test the condition at the passage of every train that receives a proceed signal. To insure that CB is in good working order the resistance of relay F is made so high that engine relay current can not get through without the aid of battery CB.

Fig 1 shows the engine apparatus in normal running condition and about to pass signal 1 (Fig 3) at proceed. The cut between engine and tender being part of the engine circuit as the engine is passing signal the while a space between the last engine wheel and first tender wheel is spanning the opposite insulated joints the engine current must find some other path than the rail ... path is provided through the coils of relay F ... CB ... same polarity as engine battery EB ... the track relay ... at signal ... is open and this ... relay F ... which reverses the polarity ... so that when a second engine tries to ... as shown at Fig ... its engine circuit ... a battery of opposite polarity which ... relay R and applies brakes. After ... reduced to the predetermined value ... in speedometer ... the key K may be used to re-energize engine relay and train may proceed.

One of the accompanying photographs shows the ... Cleveland River ... system. The ... the ground at the side of the tender has his hand on the valve key releasing the brakes after the engine has been automatically stopped. The relays and valves are all located in this box under the side of the tender.

An International Congress on School Hygiene

All the leading national ... every State in the Union every college and university of note in this country and various other leading educational scientific medical and hygienic institutions and organizations as well as various women's organizations will be represented at the Fourth International Congress on School Hygiene in Buffalo August 25th to 30th according to a preliminary statement just issued by Dr. Thomas A. Storey of the College of the City of New York secretary general of the congress.

Mr Woodrow Wilson as President of the United States has accepted the honorary office of patron of the congress. The president of the congress is Mr C. W. Eliot one time president of Harvard University. The vice presidents are Dr William H Welch the great pathologist of Johns Hopkins University formerly president of the American Medical Association and Dr Henry P Walcott president of the recent International Congress on Hygiene and Demography and chairman of the Massachusetts State Board of Health.

It is the aim of the organizing committee in charge to bring together at Buffalo ... men and women interested in improving the health and efficiency of school children and to make this congress the first of its kind ever held in America ... of direct benefit to each individual community. A programme of papers and discussions is now being arranged covering the entire field of school hygiene. There will be scientific exhibits representing the best that is being done in school hygiene and also commercial exhibits of educational value.

Nor will the entertainment of delegates in any way be neglected. Buffalo has just subscribed $40 000 toward covering the expenses of the congress. The Buffalo citizens committee has planned for a series of social events including receptions and a grand ball a pageant in the park and excursion trips to the great industrial plants and to the world wonders of Niagara Falls.

The congress is open to all persons interested in school hygiene who may join as regular active members ... the payment of a $5 fee. Application for membership should be sent to Dr Thomas A. Storey College of the City of New York New York city.

Death of Prof Slaby

Prof Adolf Karl H. Slaby of the Charlottenburg Hochschule died on April 8th at the age of sixty three. He was a pioneer in the field of wireless telegraphy. His first experiments were begun in 1897 on his return to Germany after having assisted Marconi with his work in England. With the aid of Count Arco he developed the system known as the "Slaby-Arco," which later was combined with that of Braun to form the Telefunken system. By using captive balloons to support his antennae he was in his early experiments able to establish wireless communication over a distance of twenty one kilometers (12 miles). Slaby discovered that the coherer is sensitive to difference of potential rather than to variations in current strength and hence to produce the maximum effect it should be placed at the upper extremity of the antenna. As such a location would be inconvenient he modified his system by adding a horizontal wire of equal length to the vertical but for convenience coiled into a helix, and placed his coherer at the end of this wire. Prof Slaby also contributed much to the tuning of wireless telegraph apparatus using in the receiving set the syntonizing coil with sliding contact so familiar to all wireless telegraph operators which was invented by his associate Count Arco.

The Intractable Missouri-Mississippi System

In our front page illustration this week we have attempted to present in tabloid form some statistics concerning the longest and in many other respects as well the greatest river system in the world. The Mississippi River is only about 2 500 miles in length and the Missouri River is well under 3 000 miles from its source in the Rockies to the point where it enters the Mississippi but its total length via the lower Mississippi to the Gulf of Mexico is 4 200 miles. How this compares with the largest rivers of other continents is shown graphically in our front page illustration. Even considered alone the Mississippi River equals in length the longest river in Asia.

The heart of the North American continent drains into the Missouri Mississippi system. Two fifths of the total area of the United States is comprised in this vast funnel shaped river basin. No wonder this enormous body of water is dreaded when in flood and yet the very vastness of the basin it drains mitigates the danger for the chance of a combined flood from all the tributaries of the river is remote. As pointed out in the report by Col C McD Townsend president of the Mississippi River Commission in the current SUPPLEMENT the entire Missouri Mississippi drainage area receives its water from the Gulf of Mexico and it is the prevailing wind that determines whether a flood shall originate in the northwest the north or the northeast portion of this great drainage basin.

What a flood on the Mississippi means is shown graphically by comparing it with the Niagara River. The total discharge through the Niagara is estimated at 280 000 cubic feet per second. The average discharge of the Mississippi River is 610 000 cubic feet of water per second. In time of flood this is increased many fold. A record was established last year when in the vicinity of the mouth of the Red River the aggregate discharge of the river and the crevasses amounted to over 2 300 000 cubic feet per second. This equals more than eight Niagaras.

In our illustration we have represented this enormous river as flowing into a huge water barrel. In order to hold a single minute's discharge this barrel would have to have a capacity of 138 000 000 cubic feet which would make it something like 725 feet high or a little short of the height of the Woolworth Building. If the river entered into a lake of the size of New Jersey it would raise it one foot in ten hours. It is when we consider how vast is the amount of water flowing down the Mississippi system that we realize how inadequate would any reservoir system be to keep the flood in check. As a matter of fact the present levee system is comparable to a reservoir system for within its confining walls the river is allowed to spread out beyond its normal width and to many times its normal depth and yet the waters are uncontrolled. At present the contents of the levees along the Mississippi River amount to 243 000 000 cubic yards and it has been estimated that 200 000 000 cubic yards more should be added in order to keep the waters in check.

It is interesting to note that the industrious Missouri River carries down in a single year enough sediment to build all of the present levees and practically all of the projected levees. Out of the Missouri River the Mississippi receives annually 400 000 000 cubic yards of sediment. How much this is we may realize by comparing it with the total excavation from the Panama Canal, which is estimated at about 210 000 000 cubic yards. In our illustration we show a dump car of a standard 12 cubic yard type but enlarged proportionately until it is big enough to hold the entire excavation of the Panama Canal. This car we find is nearly a mile in length measured inside the body. A similar car large enough to receive the annual sediment of the Missouri River would have to measure inside 8,100 feet in length and the body would cover over twenty-four city blocks. This we have illustrated by displaying a section of Broadway's sky line under the car. Such a car would have wheels larger in diameter than the Singer Building, and only the Woolworth Building would reach up to the ... This estimate of sediment is based on a report by Col. Suter, who made observations at St. Charles, Mo., from February to October 1879. He showed that the average sedimentary discharge was 2.3 cubic feet per thousand cubic feet of water and this rose to a maximum of 14.7 cubic feet of sediment per thousand cubic feet of water. Four hundred thousand cubic yards per year means 12.7 cubic yards per second, that is over a carload. In other words, if this sediment were carried by rail it would take an endless train running continuously, day and night all the year round at the rate of seventeen miles per hour to deliver the material in the same volume as it is delivered by the Missouri.

A New Method for Inducing Immunity Against Disease

In recent years there have been a number of successful experiments on a large scale with a view to inducing immunity against typhoid fever. It has been found however that the method of injecting the preparation under the skin is in some cases accompanied by disagreeable consequences. The use of the hypodermic injection is also by itself an additional danger point for in the hands of careless workers there is danger of blood poison. For these reasons many investigators have sought for another method of vaccination against typhoid fever. Prof Jules Courmont of the University of Lyons has found such a method.

With the aid of his assistant Dr A Rochaix, Dr Courmont first tried to introduce the vaccination material through the mouth of the animals with which he experimented—rabbits goats and guinea pigs. The material used consisted of a quantity of the typhoid toxin prepared by cultivating the bacilli in special mixtures and then heating the mass to about 128 deg Fahr. The heat kills the bacteria but does not affect the poison. If a small quantity of this is introduced into the body the white corpuscles are induced to secrete the appropriate anti toxin, and thus prepare the blood against a possible larger invasion in the future. But it was found that swallowing the toxin did not produce the desired results. This can be understood when we consider that the action of the juices of the stomach the liver and the pancreas upon the toxin must either have destroyed it or modified it considerably before it could be absorbed into the blood through the walls of the intestines.

When it was demonstrated that this method was not efficacious Prof Courmont conceived the idea of getting the material into the large intestine *directly*. For this purpose he used the same animals and gave each a number of irrigations the results were entirely satisfactory the animals becoming completely immune to typhoid germs. To make sure that the method would apply to human beings the same experiments were repeated with a number of volunteers. Each received three enemas containing about three ounces of the killed typhoid culture at intervals of five days. As it was of course impossible to infect the young men with typhoid germs in order to find out whether this intestinal vaccination was effective another method had to be resorted to. That was testing the behavior of the blood in relation to the specific microbes. Now in every case experimented upon it was found that the serum of the subject's blood killed cultures of typhoid bacteria. And in no case was there any unfavorable or even unpleasant reaction as a result of the treatment. This method promises much for our future health.

Intestinal vaccination of the same kind was also tried on the experimental animals using the bacteria of blue pus instead of typhoid bacilli. The induced immunity was complete in every case.

The Current Supplement

THE most important official exposition of the problem of controlling the Mississippi flood is unquestionably a paper read before the recent National Drainage Congress in St. Louis by Col C. McD Townsend U S A president of the Mississippi River Commission. This address is published in full in the current issue of our SUPPLEMENT.—The Stefansson Arctic Expedition is discussed by Rear Admiral Peary and Mr Clark Wissler.—Mr Eastick contributes an article on the hardness of metals.—A paper mill engine of new design is illustrated and described.—Mr G B Cortelyou's review of the development of the gas industry is concluded in this issue.—An automatic railway signaling system devised by an Australian engineer is described.—Safety lamps for miners have occupied the attention of many, since the days of Sir Humphry Davy.—An article in this issue deals with electric lamps for miners.—The fifth of Sir J. J. Thomson's lectures on the structure of the atom is reported this week. The sixth and last of this important series, in which the great English physicist summarizes the main conclusions of his brilliant researches, will appear in next week's issue.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Mississippi Problem

To the Editor of the SCIENTIFIC AMERICAN:

Why, in the name of common sense, does not some one call attention to the construction of flood channels in cities, due to reclamation of bottom lands, bridge piers, abutments, etc., as a cause of floods by reduction of channel cross-section. Now I have been very glad to see that point, which was discussed considerably in Kansas City, in 1904, taken up in your last issue, but I have one suggestion yet left to offer, viz., is it not true that the river channels have been choked, also, by the greatly increased quantities of soil washed into them from the large areas of plowed ground now found in their drainage areas? Early explorers reported many of our streams as clear, which certainly have not that character now.

Plattsburg Barracks, N. Y. G. W. EDGERLY.

The Futility of Reservoirs to Control Floods

To the Editor of the SCIENTIFIC AMERICAN:

Your idea, that the reservoir system of preventing floods in river valleys would be of but little benefit, is well supported by the recent great flood in Ohio and Indiana.

Our river valleys were full of water from source to mouth of stream to a greater height than any engineer would propose for dams. This condition prevailed for a period of three or four days. If we consider the high velocity of flood waters, we can readily see what a small portion of this water could have been held back by reservoirs. The breaking of dams, had they been in existence, would doubtless have added to the destruction of both lives and property, since people would have been less willing to leave their homes.

Nor would levees have afforded protection on this occasion. The only way to prevent losses, due to a rain like that of March 24 to 27, is to completely abandon all the creek and river valleys. That we would not think of doing, since so heavy a rainfall may not again occur in several centuries.

We have seen the streams in the condition which they must have often been during the glacial epoch.

Danville, Indiana. C. A. HARGRAVE.

An Advocate of Headwater Control

To the Editor of the SCIENTIFIC AMERICAN:

Articles on the Mississippi will be of peculiar interest this year, and the better control of discharge may be the next great national work. A recent article, interesting and plausible, would tend to claim that Nature was elevating the bed of the river itself through deposit, and that at the same time man was raising the dykes and the overflowed sediment raising the general level of the submerged land. This does seem to be Nature's process, but unless it had only local effect, it would finally create rapids at the sea, for the level of the sea will not rise to accommodate the raised bed of the river. However, rapids have not appeared to any extent as yet.

It would be of interest to know what the engineers say of this theory. Higher, larger, and better dykes would tend to scour the present channels better than ever, but will they accommodate the volume of water that must pass within a limited time?

If they will not do so, then they are only moderately useful and will not meet the greatest emergency. The control of headwaters would certainly have great effect, both on average flow and also on flood. Extra accumulations of water from various sources are at times compelled to pass the lower reaches of the river within a certain number of days, and if they cannot do it overflow is the result, and the trouble is on that stretch of river where the accumulated waters bunch up temporarily, and an improved mouth to the river would not be of assistance just there.

It would seem that control of headwaters in conjunction with the ability to heavily sluice out water at certain possible points, when the river at those points reached a certain stage, would be the only remedy, excepting that dykes on a larger scale should be still used at points where proved necessary. Partially to close off certain headwaters in case of heavy rains at all headwaters could not fail to have great effect. To hold certain waters back but a few days would have great effect. Time is the chief item in the whole flood question, and the only water that must be controlled is the excess that passes certain stretches within a certain time.

VERITAS.

Montreal, Canada.

Swamp Drainage and the Floods

To the Editor of the SCIENTIFIC AMERICAN:

I noticed in your issue of February 15th, an article on the overflow of the Mississippi River a year ago this spring. Now in my opinion you are on the right track, only you do not make it strong enough. Now I am building dry land dredges and my business calls me to different parts of the United States, and I have a chance to see what a vast amount of drainage is going on all over the country; wherever there is a chance to drain a lake, a slough, a swamp or low land, it is being done. Many of these heretofore have had no outlets, and where they did have, the outlets were many times obstructed by old logs or beaver dams or other obstructions, and many of them had no outlets at all. The water had to soak away or evaporate, which all contributed to hold back the water. Now this is all changed, or is being changed, so where it used to take two or three months to get the water off it now goes off in two or three days, and when this is being done in a vast stretch of country, the most of which empties into one river, its effects must be felt, especially when it has to be narrowed up by levees and has to run in a comparatively narrow channel where it used to spread out over several States. It is estimated that in the State of Minnesota alone there will be this coming summer 100 dredges at work and these will probably dig 1,000 miles of ditch, a large part of which will empty into the Mississippi, and some of these ditches are small rivers themselves, and this work has been going on for several years, and will be continued for some years to come. And this is but the index of other States.

Now this building of the levees along the Mississippi just high enough so that the high water just runs over the top and washes out enough to let the whole country along the Mississippi be flooded, and the next year the levees are raised a few inches higher, is not providing against a flood. This is not even providing for the extra demand which has to be taken care of from the extra ditches. We can hardly comprehend or estimate the immense amount of water that the Mississippi will be called upon to take care of at certain times of the year, when there are heavy rains in some parts of the country and heavy snows in others, extending over a vast country reaching from the Rocky Mountains on the west to the Allegheny Mountains on the east, and from Canada on the north to the Gulf of Mexico on the south, and draining approximately one million square miles of territory.

Now, as it looks to me, the only way is to build the levees that we think are high enough, and then add onto them from 50 to 100 per cent in height, and by that means they may be built high enough to stand any flood that may come. And then too we may as well count on adding some more, for sooner or later the United States will be called upon to take care of the extra water being drained into the Red River of the North from all the extra ditching going into it from Minnesota and Dakota, in consequence of which there is bound to be sooner or later high floods along the Red River, and the United States will be called upon to settle for damages caused by the extra water that the Red River could not take care of.

Tomah, Wis. A. N. GROSS.

Dams to Control Floods

To the Editor of the SCIENTIFIC AMERICAN:

A partial remedy for flood conditions as now exist has occurred to me, and as I have not seen it suggested in my reading, I will mention it.

The usual plan for controlling the heavy rainfall and ordinary spring freshets implies making large reservoirs, in deep valleys, by great masonry dams. Such a measure costs large sums of money, which, with the physical difficulties, defer or prevent anything being done until repeated catastrophes rouse an overwhelming sentiment in their favor.

I have visited much of this country, have observed its contour, and make the following suggestions.

Almost every stream has wide shallow valleys bordered by meadow land, what are called bottoms in many places. Generally before these floods, such as prevail to-day through the Middle West, the streams are low, and these valleys are not filled with water. When the heavy rain comes the water rushes down the streams till it reaches some narrow place, and at such points it begins to back up, and temporary dams are made by the accumulation of material brought down by the streams. The increasing pressure of the waters held back often becomes so great as to break through the temporary or artificial dam, and the volume as well as the force of the water sweeps all before it.

My suggestion is that low dams be put at many places in the course of streams, which would hold back the waters in shallow valleys, so that the floods would flow away gradually and harmlessly.

The fertility of the valleys of the Nile, the Mississippi, and other alluvial streams is due to the deposit on them of the silt carried in rapidly moving water, and such an annual deposit on the flat borders of streams, which would overflow their banks in times of high water only, would greatly and perpetually enrich them, while the damage would be small compared to the very great damage now done when the water escapes with a rush and an accumulation of force sufficient to sweep dams, buildings and bridges before it.

I know valleys where at suitable places even an elevated roadway crossing it with suitable spillways, would spread the flood over wide spaces to run off harmlessly later.

Earth dams with a core of masonry, when not exceeding 10 or 15 feet in height, would cost little, and if put at rather short distances apart along the course of streams, would curb the violent flow of the water, enrich the land, and in partially dry regions, like western Kansas and Nebraska, impound water which would be of great value in times of drought. The expense of such low dams, often combined with improved roads now so much in demand, would be well repaid by the freedom from such disasters as now shock us all, by the increased comfort and convenience of the people along such rivers as now overflow, and by much increased fertility to the bordering valleys.

White Plains, N. Y. SAMUEL B. LYON.

A Protest Against Amateur Flood-Controllers

To the Editor of the SCIENTIFIC AMERICAN:

I have watched with mingled feelings of amusement and disgust the lucubrations of amateur meteorologists and hydrographers, as set forth in the New York daily newspapers, with reference to the recent floods in the West. I observe that you have admitted one of them to your correspondence columns, Mr. C. A. Zander of Littleton, Del., who remarks: "I am sorry to note the stand you take in the matter of straightening out a river in your otherwise sane views of flood restrictions."

I presume this gentleman is new to the SCIENTIFIC AMERICAN, or he would know that the SCIENTIFIC AMERICAN is always sane in all particulars. In this particular item of floods you made recently the first sane statement I ever saw in print regarding the tilling and ditching and drainage of land which every farmer gets busy with as soon as he cuts off the forests, as a cause of the sudden flooding of streams.

Wise and sapient words these of Mr. Zander: "The problem of the Mississippi is the same as that with a brook, save in magnitude and constant level at outlet. A straightened bed will lower the flood crest," etc. This is on par with the rare and wonderful thoughtfulness of the Secretary of the Interior, who advised the people of Ohio to dig "runways for the floods." I have before me a photograph showing the Ohio River at Cincinnati at a stage fully six feet below the recent high record. The river reaches from the Kentucky hills, some four hundred feet high, to the foot of the hills on the Ohio side. All that is necessary in order to carry out the Secretary's brilliant plan is to set those hills back perhaps half a mile for a distance of some 700 miles—and then dig the "runway." Mr. Zander's idea of the Mississippi is equally comprehensive, brilliant and practical: "Begin at the mouth, straighten channel any distance, make waterway wide enough and dyke high enough to take flood with a good margin of safety added." Does this gentleman know that the Mississippi River carries at flood tide enough water to cover his delightful little State more than four feet deep in a single day? Does he know that the Mississippi River drains an area about 700 times the size of the State of Delaware? Did he ever watch tall trees falling into it one after another as it carved land off the banks by the township?

I see no reason why his blithely propounded formula could not be applied to even greater affairs. For example, a bridge across the Atlantic: "Build your piers high enough above flood tide, connect them with trusses, and lay your tracks." Or a railroad tunnel straight through the earth: "Dig a hole deep enough, shore it up safely, provide an elevator to the center and a corresponding one on the other side."

No doubt improvements will be made in the control of the Mississippi, as well as in the control of the floods in all parts of the Ohio River watershed, but the work will be best accomplished by people who live there, people who have lived through the floods, and who have some sensible conception of the size of the job. And after all the flood controlling is done, Nature some day will turn loose a heavier rainfall than man had ever seen before, and the flood defenses will operate simply as a means of sudden precipitation of the calamity when they yield before Nature's power!

I have seen the Mississippi River eight miles wide at St. Louis, with a current of nearly six miles an hour, and I protest against the annoying of people who are suffering from the ravages of the flood at this time by nonsense from engineers of the kindergarten stage whose fields of observation have been spring tides in the Erie Canal or the gaging of some creek whose annual flow would not equal the Mississippi's rate per minute. Furthermore, I have full confidence that the SCIENTIFIC AMERICAN'S outgivings on the general subject of flood control will continue to be not only partly sane, but entirely so.

WALTER C. TAYLOR,

Boston, Mass. Editor *The Boot and Shoe Recorder*.

Floods and the Problems of River Regulation

By Charles Whiting Baker, Editor in Chief, Engineering News

Condition of caving bank at Caruthersville, Mo., at the time of beginning bank protection work.

THE heavy rainstorm which swept across the country from Illinois to New England during the first week in March caused greater property damage than any other storm that has ever visited the United States. Public attention has been largely concentrated on the loss of life and property in such sorely stricken cities as Dayton and Columbus, but there were numbers of other smaller cities and towns in Ohio in the valleys of the Miami and Scioto and Muskingum rivers which suffered as severely. In fact, all through southern Ohio and Indiana and the whole length of the Ohio Valley every town and city located on a river bottom sustained heavy loss.

So widespread were the floods, reaching eastward through northern Pennsylvania across the State of New York and even into New England, and westward and southward along the Mississippi River to the Gulf of Mexico, that nothing short of a census enumeration could determine approximately the damage suffered by probably a hundred thousand households and as many farmers in injuries to land.

Immediately following this widespread destruction there has arisen a public demand that something be done to guard against like destruction in the future. Bills are being introduced in Congress, prominent public officials are expressing opinions, the daily newspapers are making divers suggestions. It is important that the public should have an intelligent understanding of the subject.

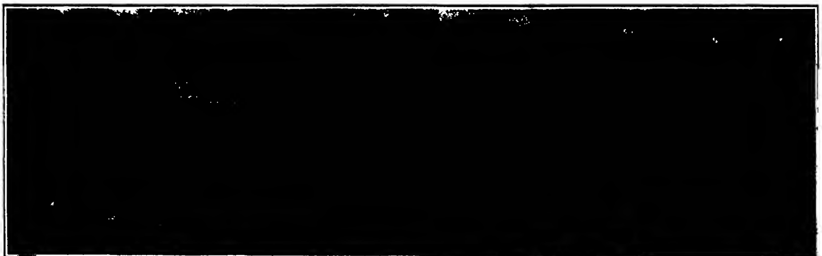
And in the first place it may help us to form sound opinions if we understand that there are clear and definite limitations as to what is possible of accomplishment. After all, man is a puny creature compared with the mighty forces of Nature. He has indeed harnessed some of these forces, but he has been able to do this only by studying the laws which govern these forces and working in harmony with these laws. Long ago the work of the engineer was defined as "the harnessing of the great powers of Nature for the service of man." It is the engineer's business to know what can be and what cannot be done with these forces.

The Cause of the Recent Floods.

The first thing an engineer does when he sets about the solution of a problem is to measure and weigh the quantities with which he has to work. As soon as the news of the recent floods came, engineers set to work to determine the rates of rainfall which caused them and the volume of flow in the flooded streams at various points. It is now known that the rainfall which caused these great floods was phenomenally heavy over a belt of country stretching across northern Ohio along the low and flat divide between the rivers which flow north into Lake Erie and those which flow south into the Ohio River. At Marion, Ohio, 10.10 inches of rain fell in four days, at Bellefontaine, 11.16 inches, at Bangerville, 30 miles east of Marion, 9.50 inches. This is as much rain as ordinarily falls in the space of three months in this section. It fell at a time, moreover, when the ground was already saturated and when there was very little evaporation, so that almost the whole of this enormous amount of water flowed quickly off into the streams. It was the long time that this steady downpour continued and not the amount of rain falling in a single hour which caused the damage. A summer thunderstorm often delivers a heavier precipitation over a small area for a few minutes or even an hour than fell in the same time in this Ohio storm. Such heavy thunderstorms over a small area often do excessive damage in the washing out of roads and culverts through the overflow of brooks and small streams. In the Ohio floods, however, hardly any of the small roadway culverts were washed out, but the bridges over the larger streams were carried away, proving that it was the long duration of the steady rainfall extending over a wide area, which was responsible for the great damage.

One of the most common and widespread fallacies with reference to floods is that they are more frequent now than in former years, and attain higher elevation, and that this is due to the clearing of the *forests and the cultivation of the land*, the draining of swamps, etc. This idea is so firmly rooted in the popular mind that it will probably surprise many to hear it called a fallacy, especially as many distinguished men have given the theory prestige by their support.

It must be said nevertheless that in the opinion of the highest scientific authority the presence or absence of forests on a watershed has very little influence on floods in the streams which flow from it. It is another common fallacy that the presence of forests increases the amount of rainfall. There is no satisfactory evidence that this is the case, at least under the climatic



Crevasse in the levee at Wilson, Arkansas, taken from the south end of the break.

Part of the broken end of the levee is shown in the foreground, the other end is beyond the trees. The water is pouring through this half-mile break, with a ten foot head and is flooding an area forty miles wide and one hundred miles long.

conditions that exist in the United States.

The idea that the climate is gradually changing stands on no more substantial basis, when one studies the weather records extending back not merely over the few years that the average person remembers but over a half century or a century. There is no reliable evidence that there has been any appreciable change in climate, so far back as authentic historic records extend.

There are, however, from causes not fully determined recurrent cycles of wet years and of dry years. Such a cycle of dry years, for example, during which hundreds of cities in all parts of the East suffered from insufficient water supply as a result of the drought, came to an end about two years ago. As according to the old adage, one extreme follows another, we are apparently now beginning a cycle of wet years during which the average annual rainfall will be excessive instead of insufficient.

Forests and Floods.

It may be of interest to explain some of the reasons why the presence of forests upon a watershed has comparatively little effect upon floods flowing from it. That it does have some influence in equalizing the rate of runoff from a drainage area *during periods of ordinary rainfall* is well understood. But the mulch of dead leaves which covers the ground under forest trees has only a limited capacity for absorbing water. According to the depth of this mulch and the character of the underlying soil this mulch may be able to absorb like a sponge perhaps half an inch an inch or even two inches of rainfall. After the point of saturation is reached however further soaking in is very slow, and if an additional heavy rainfall comes, it runs off very rapidly on the water surface formed by the rain which has previously fallen.

Some of those who have strongly advocated forest cultivation as a protection against floods have attempted to illustrate the behavior of the forest mulch in absorbing and equalizing rainfall by covering an inclined board with a sheet of blotting paper and showing how the blotting paper absorbs water sprinkled upon it, where water sprinkled on the bare board runs quickly off. But if this little experiment is carried further, it gives an excellent object lesson why forests do not and can not prevent floods. Continue the sprinkling of the blotting paper with water and after it has become saturated the water runs off as readily as it would from the smooth board without the blotting paper.

This is what happened in the recent Ohio storms. Day after day the rain steadily poured down upon ground already saturated from the winter snows and rains, and as soon as the ground surface was covered with water the additional rain flowed rapidly off on the surface of the water underneath. When it is remembered that the total depth of the rain which fell in this four-day storm was nearly a foot at some points, it can readily be understood why there was a rapid and enormous discharge into the Ohio rivers and why this discharge would have taken place and the great floods have resulted just the same, even if the whole State of Ohio had been covered with primeval forests.

Besides this there are many instances of great torrents flowing from [illegible] which were covered with [illegible] forests. An [illegible] [illegible] Hudson River. The flood in this river on March 27th to 29th was enormous and caused great damage at Troy and Albany, yet the height which the flood attained and the volume of water flowing in the river were after all less than in the flood which occurred in February 1857. Now the Hudson River above its junction with the Mohawk receives nearly all of its water from the southern part of the Adirondack region. In 1857 nearly the whole of this region was covered with primeval forest. Better proof that a forest cover upon a watershed cannot prevent great floods in the streams flowing from it could scarcely be given.

Old records show also that in 1832 there was a flood in the Ohio River at Pittsburgh which was five feet higher than the flood of last month. In 1832 however a very large part of the watersheds of the Allegheny and Monongahela which meet in Pittsburgh to form the Ohio was covered with dense forests.

As to the prevalent idea that the cultivation of the prairies and the draining of the swamps has increased the floods in the Mississippi River, it is of interest to note that the greatest flood height on record in the Mississippi River at St. Louis occurred in 1844 and the next highest in 1785. At both these dates the entire territory drained by the upper Mississippi and the Missouri rivers was in its natural condition. The trifling amount of settlement and cultivation at that early period could have had no influence on the rate of runoff.

Similar instances without number could be multiplied all going to prove that the volume of flood flow in our streams and rivers has not been materially altered by any *changes which man has brought about*. The floods which have wrought such destruction this year therefore are nothing but what have occurred before and will doubtless occur again, and there is no evidence to show that they are likely to come with any more frequency in the future than in the past.

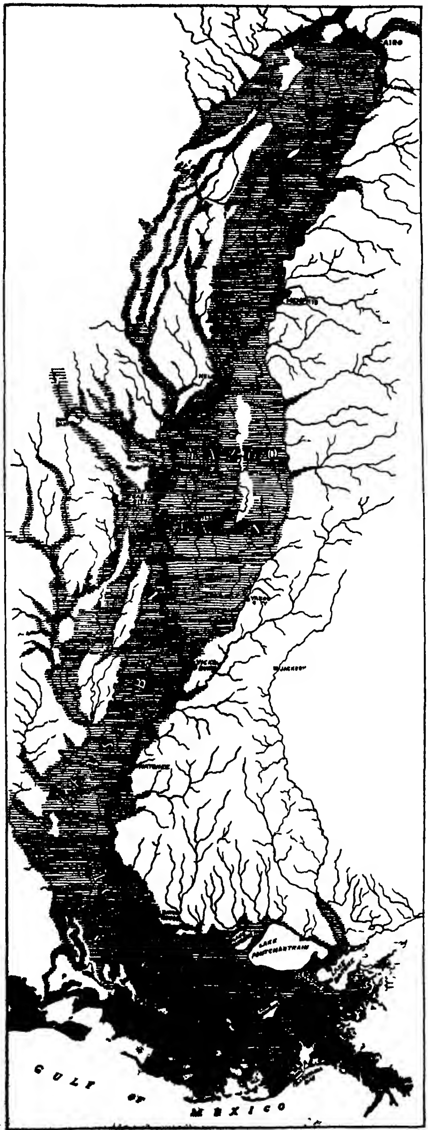
How Far Man is Responsible

While there is thus no evidence to show that the changes brought about by man upon our continent at least have affected the rate of rainfall or of the run-off from drainage areas so as to have any influence on floods there are certain changes for which man is responsible which have affected the ability of the river channels to carry these floods.

Where rivers pass through cities their channels have often been narrowed by gradual filling in of the banks on either side. Individual property owners along the shore have a strong temptation to do this because of the additional area of land which they thus secure. Bridge piers and dams in a stream also operate to reduce the channel capacity. Most serious of all however are the obstructions which have often been placed across the flood plains of rivers.

As everyone knows most streams and rivers flow in a comparatively narrow channel through a broad valley and are bordered on either side by broad stretches of meadow or bottom land. These bottom lands are termed by geologists the river's flood plain. They have gradually been built up through long ages past by the deposit of sediment from the river when in high flood.

To man with his short span of years on the earth floods high enough to cover these bottom lands seem to come at long intervals



The lower Mississippi, showing by shaded lines the 20,000,000 acres protected from inundation by levees.

The lands protected by the levees are wonderfully fertile and many plantations are valued at $100 to $200 per acre. Breaks in the levees in the great flood of 1913 inundated only a small part of this area.

apart and it seems incredible that these broad plains with their deposits of sand and gravel and silt many feet in depth have all been brought down and deposited by the stream during periods of high flood. The deposits themselves however tell a story whose truth it is impossible to contradict. These broad level bottom lands along every stream are proof in themselves that the river has in past ages frequently covered these plains and while it is true that many such bottom lands probably gained much of their deposit during the geologic epoch following the glacial period when enormous runoffs and erosion occurred, it is also true that many of these flood plains are the results of deposits made within historic times.

In other words, every river has two channels. The first its ordinary channel, carries the whole flow of the stream at all ordinary stages. The second or flood channel is inundated by floods which may occur on some streams once in a decade, in others once in a half century or century or perhaps at even longer intervals.

The bottom lands, or flood plains along a river are invariably fertile and productive hence they usually support a dense population. Again nearly all cities and towns are built on rivers of greater or less size. They were originally located there because of the advantage of transportation or water power or water supply and as they have grown they have spread over the flood plain of the river and are subject to inundation, therefore when once in a century or oftener, a record-breaking flood in the river occurs. The height of such floods is increased, as is also the velocity of the current by the obstruction to the water's flow by the encroachments on the channel and the buildings and the obstructions built on the river's flood plain.

Still another way in which man has affected the capacity of rivers to carry floods is when by cultivation forest removal, road construction etc., he has caused earth and sediment to be carried into the streams, which has tended to fill up the channels.

The amount of this injury to river channels, however has been probably overestimated by many. The large rivers have suffered little deterioration of their channels so far as measurements can determine. There are, however, certain localities where the work of man has undoubtedly injured the rivers. Most notable are the rivers of California which years ago received the débris from hydraulic mining.

So far as the rivers whose floods caused such destruction in Dayton and Columbus are concerned it is doubtful if any material shoaling of their channels had occurred as the result of sediment carried into the streams the volume of the flood water was so vast that had the ordinary river channel been as much as five feet deeper or five feet shallower, the flood destruction would have been little affected either way.

To recapitulate then, the recent floods were caused by an extraordinarily heavy rainfall, and nothing that man has done in removal of the forests, cultivation of the ground or drainage of swamps had anything to do with it. Such floods have come before and will come again but at long intervals. To such occasional devastation every city built upon a river's flood plain is liable but since floods are not increasing in frequency or in height the danger is no greater to-day than it always has been.

It must be remembered, however, that the flood plains of a river may be at various elevations. Some parts may be overflowed by such high water as comes every year or even several times a year some parts are reached only by such floods as come on the average at intervals of five or ten years other places are inundated only by such extraordinary floods as may occur at intervals of a century.

How Floods May be Controlled.

There are two general methods by which the flood waters of a river may be controlled and prevented from spreading over its flood plains. The first is to build embankments or levees along the river banks so as to confine the waters within the ordinary channel. The second is to build reservoirs upon the tributary streams which form a river and store up in them the flood waters, to be gradually discharged later to supplement the river's low-water flow. The relative merits of these two methods are just now the subject of active public discussion.

The reservoir system is, upon a superficial observation, very attractive. The proposition to store the water which would otherwise rush down the valley creating waste and destruction along its entire path to the sea, and to use this stored water to develop power, to irrigate lands in time of drought or to increase the low water flow of the rivers for the aid of irrigation—all this seems on its face to be an ideal plan.

Moreover, its advocates can point to instances where river regulation by these methods is being actually accomplished. The Croton River for example, which furnishes New York city's present water supply, has had so many reservoirs built upon its watershed, that unless a very heavy rainstorm should come at a time when the reservoirs were all filled, the entire flow resulting would be caught and stored for the city's use. Boston stores the Nashua River's flow in a similar way. At Panama, the floods in the Chagres River are now stored in the great Gatun Lake, which will become as it reaches its final depth and area the largest artificial body of water in the world. Still again in the arid West, great irrigation works are dependent on the storage of flood waters in huge reservoirs.

The Reservoir System.

It is to be especially noted however, that all these reservoir systems are on *rivers of small size*. Further, their construction has involved a huge expenditure. The city of New York has spent millions of dollars on a single one of its reservoirs in the Croton watershed. The Gatun dam is an essential part of the $400,000,000 Panama Canal works. Such expenditure can be afforded because of the high value of water used for a city's water supply, or even for irrigation.

When we apply the cost of reservoir construction per million gallons of water stored to the huge volumes of water required to be stored if we are to take care of the flood waters of rivers draining thousands of square miles, the magnitude of the sum required becomes appalling.

During the recent floods at Columbus, Ohio, the volume of the Scioto River's flow where it passed over a great weir dam just north of the city was very accurately determined. In round numbers, at the crest of the flood, the river passing through the city had a volume of 138,000 cubic feet per second. A river in flood with a swift current may have an average velocity of four miles an hour or approximately six feet per second. Such a river with an average depth of 15 feet would have to be 1,555 feet in width to discharge a volume of 138,000 cubic feet per second.

If the reader will picture to himself some of the natural lakes or artificial reservoirs with which he is familiar and imagine such a great river flood, more than a quarter of a mile in width, sweeping down into it, he can realize how brief a time it would take for such a flood to fill it.

In the city of Columbus, the river covered the entire width of its flood plain, a breadth of over two miles. There are very few artificial reservoirs anywhere which have as great a width as this. When one witnesses such a river as the Scioto, which at lowest water can hardly float a row-boat, transformed into a stream from half a mile to several miles in width, it can be appreciated what vast reservoirs would be required to store any considerable part of the flood flow.

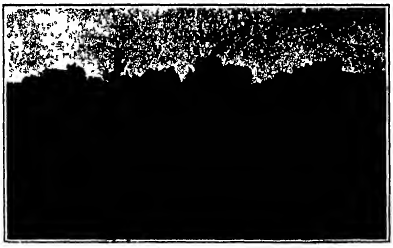
Where could such great reservoirs be

A Lake steamer was broken from its moorings by the force of the current and was carried against the pivot pier of a swing bridge across the river. It knocked the bridge off the pier into the river causing a loss of a quarter of a million dollars.

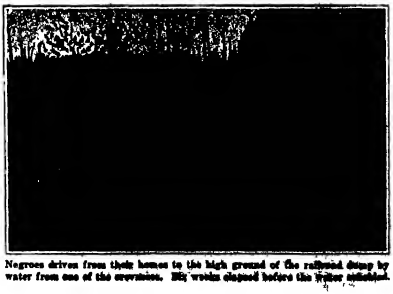
Wreck of a swing bridge over the Cuyahoga River at Cleveland, Ohio.

This mat floating over the section of bank to be protected, is being held in place by wire cables while stone is unloaded from the barges and placed evenly upon it in the cribs provided. It will sink uniformly into place and will extend from the water surface toward the bottom of the river like a great rock curtain. These revetments, as they are called, cost from $28 to $30 a running foot. If the caving bends could all be treated in this way the channel would remain permanent.

Example of bank revetment work.



Upper bank protection, showing sill dams at Atchafalaya.



Negroes driven from their homes to the high ground of the railroad dump by water from one of the crevasses. Six weeks elapsed before the water subsided.

located? The river which flows past Columbus drains some of the most fertile and densely populated farming regions of Ohio. The dwellers in these upper valleys would resist to the utmost the appropriation of their lands for reservoir bottoms.

Moreover, storage reservoirs can be economically built only where a deep narrow gorge occurs on a river below a broad level valley. Such reservoir sites in northern Ohio are lacking. Still further, in order to have prevented the recent floods by storing the flood waters, reservoirs of huge capacity would have been necessary on the Wabash, White and Whitewater rivers in Indiana, on the Maumee, Cuyahoga, Miami, Scioto and Muskingum in Ohio, on the Allegheny and Beaver in western Pennsylvania, on the Genesee, Mohawk and Hudson in New York, and on a multitude of smaller streams besides. And the next great flood bringing rainfall may come on an entirely different territory, where these reservoirs would be of no use.

At the recent National Drainage Congress in St Louis, Col. C McD Townsend, U S. A., president of the Mississippi River Commission, presented a graphic statement showing how the floods on the lower Ohio and Mississippi rivers are due to rainfall upon their lower tributaries rather than from the distant headwaters in the mountains, where the advocates of reservoir control propose to store the water

In the recent Ohio River flood, the city of Cairo, at the junction of the Ohio and Mississippi, was so threatened that women and children were sent away and the city was more than half depopulated. The crest of this flood reached a greater height at Cairo than any ever before recorded. Suppose there had been a huge storage reservoir available, not merely on the headwaters of the Allegheny and Monongahela, but at the city of Pittsburgh itself. Suppose there had been another such huge reservoir at St. Paul, Minn., capable of taking all the flow of the upper Mississippi. Suppose another had existed at St Joseph, Mo., sufficient for the whole flow of the Missouri

The length of time required for a flood wave to pass downstream from these several points to Cairo is known. Suppose therefore that in order to protect Cairo and the lower Mississippi Valley from the recent flood the gates of these reservoirs had all been closed, so that not a drop of water would have been allowed to flow past Pittsburgh or St Paul or St. Joseph until the flow would be too late to meet the flood from the lower Ohio tributaries and add to the volume at Cairo. Col Townsend then shows that the recent flood flow of 2,000,000 cubic feet per second, which the river at Cairo attained at its record height, would have been diminished by only 85,000 cubic feet per second by such reservoirs, or *less than two per cent* of its total volume.

Limitations of space forbid a further explanation of the inherent difficulties which make control of the floods of great rivers by artificial reservoirs as difficult and impossible in practical execution as it is attractive when viewed superficially

Merits of a Good Levee System.

Attention may be turned therefore to the levee system of river control, which has been adopted by engineers the world over to protect the flood plains along a river's course from inundation. In the United States the best known example of river control by levees is the lower Mississippi River. This river is now bordered on either side by levees having a total length of some 1,525 miles, containing nearly 250,000,000 cubic yards of earth. These levees protect from inundation some sixteen million acres of lands as fertile as any on the globe. In its present condition the levee system is sufficient to confine all ordinary floods, and in all the years from 1897 to 1912 the floods of the Mississippi were held between the levees except for a few small breaks in 1903. The extraordinary flood of 1912 and the one which is now passing down the river have each exceeded all previous records in volume; and will doubtless result, as they should result, in large expenditures to raise and strengthen the levees and to revet caving banks along the rivers.

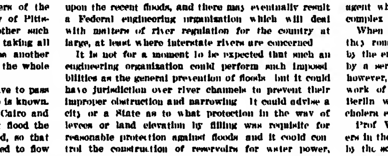
That a few weak places in the levees failed in last year's flood and this year is no fault of the levee system, but is due to the fact that the levees have been built not to the height and the width and the strength that engineers know to be advisable, but by such makeshifts as the local owners along the river were willing to tax themselves for. To raise and strengthen the levees so that they would be safe against floods much higher even than those of the present year would cost less than $4 per acre of land protected, and as much of this land is worth $100 per acre or more, it will be seen that such strengthening of the levees is easily practicable financially at the expense of the property benefited.

It is doubtless too much to expect that the general public, deceived as it is apt to be by the pseudo-science of the newspapers, will form correct opinions on such matters as river regulation and flood control for a long time to come. It may be hoped, however, that the public will learn to rely in such matters on the opinions of expert engineers. Already the Secretary of War has convened a board of engineer officers to report upon the recent floods, and there may eventually result a Federal engineering organization which will deal with matters of river regulation for the country at large, at least where interstate rivers are concerned

It is not for a moment to be expected that such an engineering organization could perform such impossibilities as the general prevention of floods but it could have jurisdiction over river channels to prevent their improper obstruction and narrowing. It could advise a city or a State as to what protection in the way of levees or land elevation by filling was requisite for reasonable protection against floods and it could control the construction of reservoirs for water power, irrigation, water supply, etc. so that State boundaries should not stand in the way of providing for the greatest benefit to the greatest number of people with the minimum of expense.

The prehistoric mounds of mound builders are sometimes thirty feet high and one hundred feet in diameter

Live stock which has taken refuge on a prehistoric mound.



This is the levee line along the St. Francis Basin; it extends from Point Pleasant, Missouri, to Helena, Arkansas—a distance of two hundred miles. When a break like this occurs, three million acres are flooded if the entire basin fills up. This view is taken from the inside and shows the height of the earthen wall that is holding back from ten to twelve feet of water at the river side

A pen built around a leak on the inside of the levee with sacks of earth.

The Death of Carl Hagenbeck

ON April 14th, Carl Hagenbeck, the well known dealer and trainer of wild animals, died at the age of sixty-nine. He supplied many of the zoological gardens of the world as well as many circuses with their collections of wild beasts. His famous private zoological garden in Hamburg has been described in these columns. Our readers will recollect that instead of confining animals in cages, he allowed them to roam at will in the open air, preventing their escape by means of ditches filled with water

Antiseptic Properties of Tobacco

LIKE many other narcotic poisons, nicotine has certain properties which give it definite value in medicine when employed in the proper way and by competent agents.

Thus poultices of fresh tobacco leaves have long been employed to give relief in cases of gout, neuralgia, and rheumatic pains. A concentrated solution of the fresh leaves is said to be good for dandruff ringworm etc. Tobacco is also employed as a remedy for skin diseases of cattle, and is commonly used to destroy parasites in vineyards and orchards. Recent investigations showing its high value as an antiseptic agent are summarized in *Le Correspondant* (Paris) from which we quote. The researches of Tassinari and Molisch have now demonstrated the actual antiseptic value of tobacco with regard both to vertebrates and to inferior creatures.

Tobacco smoke serves to retard or arrest the development of certain pathological bacteria. Amoeba ciliated infusoria etc, soon die in the tiny glass cage in which they are placed for study under the microscope, if a single puff of tobacco smoke be injected therein. It seems to act upon them as an anesthetic, exactly as do the vapors of ether and chloroform

This bactericidal and antiseptic action has not yet been fully elucidated, but the Italian physiologist Cavarallo has proved (*La Stomatologia*, Milan 1910) that smoking not only increases the flow of saliva (which probably explains the uneasiness of smokers after eating until they are able to indulge in pipe or cigar) but also sterilizes it. He also declares that tobacco is never the cause of oral inflammation and the epithelial tumors of mouth and tongue, though it may be the determining agent which makes such causes, which are many and complex in character active

When these statements of Cavarallo were published they roused much controversy being bitterly attacked by the enemies of tobacco, though they were supported by a series of clinical experiments. His conclusions, however, have just been brilliantly confirmed by the work of Prof Wencke of the Imperial Institute of Berlin who made many experiments during the recent cholera epidemic at Hamburg

Prof Wencke was struck by the fact that the workers in the cigar factories of that city were not attacked by the scourge even when living in surroundings similar or identical with those of its victims.

On making investigation he found that the water employed in one of these factories contained considerable numbers of septic vibrions, yet none of these was found alive on the finished cigars. This led him to definite experiments. Some of the tobacco leaves were moistened with water containing the bacilli of cholera in the number of 1 500 000 000 to the cubic centimeter. At the end of 24 hours these were all found to be dead

A second experiment was made with saliva containing cholera germs, placed on a glass plate and exposed for 5 minutes to tobacco smoke, which completely sterilized it

Finally it was found that a fumigation of from 25 to 30 seconds with tobacco smoke sufficed to disinfect the *dejecta* of patients seriously affected by attacks of cholera

It is believed that other harmful microbes will be shown by future experiments to be similarly destroyed

A Silicious Wood Preservative

TECHNICAL journals have recently mentioned the impregnation of timbers with melted paraffin and naphthalene, but the new Marr process is a great advance on this method. Diatomaceous earth, a silicious material, is ground so fine that ninety two per cent passes a two-hundred mesh screen. This is mixed with the melted paraffin and the naphthalene and timbers immersed in the mixture for four hours. As compared with the twelve to twenty four hours required in creosoting, this is noteworthy. Furthermore, it is an open vat process. The wood is permeated to the center and resists the attack of marine borers and decay besides gaining in resilience. Nails hold better and do not rust nor does the wood become waterlogged. Hardwoods like white oak which resist other treatment yield to this preservative. The expense is small, for the mixture costs only three cents per pound and less than two pounds of solution are required for each cubic foot of timber

The Hydro-Aeroplane Meet at Monaco

Description of the Machines and the Tests Which They Had to Undergo

WE illustrate on this page some of the score or more hydro-aeroplanes and flying boats which took part in the second annual meet at Monaco. While nearly two score machines were to compete in this meet but sixteen qualified by being exhibited prior to the meet on April 3rd. These included three Deperdussin monoplanes two Nieuport monoplanes, two Borel flying boats two Astra biplanes, two Breguet biplanes one d'Artois biplane one Morane monoplane and one de Marcay monoplane with foldable wings. These machines were arranged in four rows just inside the harbor line as shown in our illustration. Three or four of them made their first flight at this meet on the 3rd ultimo In the evening, however, and throughout the whole of the next day a heavy gale prevented any flying, and the machines were obliged to be sheltered with the exception of two—Prevost's Deperdussin and the de Marcay foldable wing monoplane both of which rode out the storm at their moorings. The latter machine was illustrated in the SCIENTIFIC AMERICAN something over a year ago. It is a novel machine the wings of which are arranged to pivot around an axis near their inner end and to fold back alongside of the body of the monoplane

No flying of any account occurred again until Sunday April 6th upon which day preliminary flights were begun Gaubert on the Maurice Farman and Labouret on the Astra biplane, together with Weymann and Espanet on Nieuport monoplanes, accomplished the starting, towing, and navigability tests. Gilbert on a Morane monoplane carried out the first and Bregi, on the Breguet biplane, the last of these three tests.

The following day Labouret's Astra biplane landed on one wing and capsized with serious result The three Deperdussin monoplanes were also put out of commission, seemingly from striking the water too sharply Fortunately, this did not happen until after Prevost had succeeded in completing the three tests above mentioned, and also the altitude and volplané test as well he being the only one to accomplish the two latter tests up to that time. The two Borel monoplanes completed the starting, towing, and navigability trials while Gaubert and Bregi finished The various tests to be made were divided under six heads, and were as follows (1) The starting test. After the machine had been brought to a standstill on the water, the motor was stopped and the pilot obliged to start the motor with the sole assistance of the passenger and without touching the propeller, and then to cover a distance of 100 meters between two lines of buoys.

(2) Altitude Test.—The machine must rise from the water to a height of at least 500 meters and return to the water in less than thirty minutes.

(3) Volplané Test.—The machine must rise from the water to the height of at least 100 meters, shut off the power, and glide to the surface

(4) Handling Test.—The machine must be brought to the crane and fastened to same so that it could be raised and lowered without damaging it

(5) Towing Test.—The machine must be towed by a rowboat or motor boat over the course used in the first test

(6) Navigability Test.—The aeroplane must circle a course of 6¼ kilometers under its own power without leaving the surface of the water All the above tests except No. 4 took place outside of the harbor in open water As the result of this, Fischer had his Henry Farman biplane pretty well smashed by a descent into the water when he was flying in a terrific wind of forty miles an hour velocity early in the meet while Louis Gaubert was drowned as a result of his machine diving below the surface when he was skimming close to the waves on April 10th The accident is said to have been caused by the tip of one wing striking a wave, whereupon the aeroplane dove beneath the surface, causing the aviator to be drowned before he could free himself This is the most remarkable hydro-aeroplane fatality which has occurred, and it was probably the result of flying too close to the water when there was a heavy sea.

The race for the Jacques Schneider International Aviation Cup for Hydro-aeroplanes occurred on April 17th and was won by Maurice Prevost on his 160 horse-power Gnome-engined Deperdussin monoplane The race was over a course of 150 nautical miles, and besides the cup there was a cash prize of $5,000. The photograph of his machine with the completely inclosed motor, having a central rounded shield, is reproduced herewith. The race was an international affair, with Charles T Weymann representing the United States with a Nieuport monoplane. Garros with a Morane monoplane and Espanet with another Nieuport represented France.

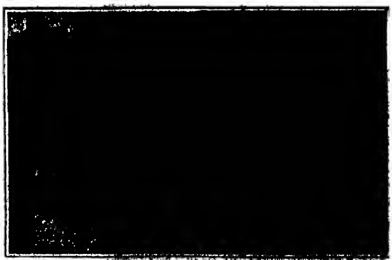
Early in the race Garros experienced engine trouble and had to alight upon the water and be towed back for repairs. After his second start, he again had engine trouble and was again towed into port, but as Espanet had abandoned the race, Garros took heart and started for a third time. Prevost, of course, reached the finishing line first, but he was skimming along on the surface of the water and was not flying. It was decided that he must cross the line once more, this time in full flight, in order to win. Weymann, who was pressing him close, was obliged to descend on account of motor trouble. He had failed to carry enough lubricating oil to finish the race. Also, not knowing that Prevost was obliged to cross the line again, he quit without attempting to finish. Garros was still flying when Prevost made his second crossing of the finishing line, but he immediately landed and withdrew when he saw the race had been won. The race was flown under ideal weather conditions, but it was not at all exciting on account of the numerous motor failures.

As for the machines which participated in the Monaco meet this year, most of these were equipped with double floats. There were several examples, however, of single float equipment, such as that shown on the Breguet biplane fitted with a 200 horse-power, horizontal, circular Salmson motor illustrated in one of our pictures. Whether there is a single or double float under the front of the machine proper, there is always a small float under the tail to carry the weight in the rear In the case of the Henry Farman biplane, two cylindrical floats were used—one on each side at the rear The single floats are generally notched and are in reality single step hydroplanes, but when double

Rear view of Borel flying boat.
Note peculiar floats on ends of triangular wings forming lower plane of this biplane. Also elevator hanging down over vertical rudder

Fischer's Henry Farman biplane at rest.
Note the sharp angle at which the machine is placed, also cylindrical floats at rear

Breguet biplane with 200 horse-power Salmson motor.
In addition to the single main float, there are two smaller boat-shaped floats, one on either side.



Astra [illegible]
The motor of the [illegible]

floats are used, these are generally flat on the bottom after the manner of the Curtiss. Most of the floats are flat, scow-shaped affairs, though some of them are more or less pointed and rounded off on top. As a rule, they are made of wood or of veneer, but when cylindrical floats are used, these of course are of metal. The floats used on the Nieuport monoplane have little wings on each side for the purpose of stopping the float from diving and drawing the machine under in a sea.

There were a number of flying boats on the order of those originated by Curtiss and Donnet-Levêque. One of these, the Borel, we illustrate. This is in reality a monoplane, although it is intended to be a biplane and is really in the biplane class on account of the small fins, one on each side of the boat, that represent the lower plane. These fins each have rather clumsy, rectangular, fish shaped floats beneath their outer tips. The men occupy a position side by side in the front part of the body of the machine, which forms the boat, while the Gnome motor is placed above at the rear edge in a notch in the plane.

Curtiss is at the present time building a new form of flying boat for Mr. Harold McCormick of Chicago, in which the motor is placed forward of the two planes and about half way between them, while the boat is beneath the planes and the passengers occupy a position about on a line with the rear edge of the planes, but beneath them. This seems an excellent design, as in case of a plunge into the water, the motor would be unable to fall upon the occupants or in any way trouble them. The placing of the motor in the boat well forward would also seem to be a good location.

The Monaco meet has demonstrated the safety of the hydro-aeroplane and the usefulness of the flying boat, and without doubt such craft will increase and multiply very largely both here and abroad during the coming summer.

Breguet hydro-biplane with vertical Salmson motor
Note the neat floats at ends of lower plane. The one beneath the tail is hidden, but the struts supporting it are visible

Front of Prevost's Deperdussin with 160 horse-power Gnome.
The three floats are clearly seen. Note the hemispherical wind shield on motor to reduce air resistance. The body has a stream-line form

General view of the hydro-aeroplane "port" at Monaco.

Artificial Limbs: Ancient and Modern

By Arthur H. J. Keane

MAN is undoubtedly the superior of the Animal in many ways, but it cannot be concealed that, in some things, animals have considerable advantages which we may well regard with envious eyes. Take the crab and the lobster (to mention but a couple by way of example), for instance, should one of these creatures lose a limb as the result of accident, attack or strife, kindly nature at once sets to work to supply the individual with a fresh member quite as good if not better than its predecessor.

Man, on the contrary, has to rely upon his wits to make good those losses which result from his wars, street accidents, railway collisions and other *del ex machina* to which he is exposed at any minute. Many of the marvelous artificial aids now obtainable are regarded as essential products of modern times, but, as a matter of fact, appliances of this kind are by no means modern. In the museum of the Royal College of Surgeons, Lincoln's Inn Fields, London, there is an artificial leg, made about 300 B. C. of bronze, wood and iron. Again, who has not heard of the famous "Iron Hand" made in Nuremberg, Germany, in 1504, for the German knight, Götz von Berlichingen? Among the old-time Indians, ears, noses and lips of plaster were quite common, one of their ordinary punishments being to cut off these useful parts of the human anatomy. Greek and Roman veterans who had lost a leg or an arm in the wars used to replace them by very capable substitutes, and Plinius speaks of a Roman soldier who (about 150 years B. C.) was famous for his wooden hand with which he was still able to fight as an able swordsman. In 1604 the Duke of Brunswick had to use an artificial hand.

Artificial limbs with movable joints were also largely made by the famous Ambroise Paré (1517 to 1590), the celebrated French surgeon known as "The Father of French Surgery." He was surgeon to Henry II. [illegible] and also to Francis II., Charles IX., and Henry III. He substituted the ligature of arteries in the treatment of gunshot wounds which, previously, had been cauterized with boiling oil. Later on, Father [illegible] made [illegible] for the manufacture of movable arms and hands. About the middle of the seventeenth century Falcinelli, a Florentine surgeon, mentions artificial eyes of gold, silver and crystal painted in different colors. He also describes gold and silver ears which were either tied to the head with strings, or else sewn on the skin of the scalp by the aid of gold and silver wire. Silver noses are spoken of also as having been in use for a long time.

Artificial arms, legs and hands are fairly well known and need but little description. Of the more-concealed members we may mention artificial feet, which vary considerably in construction, material and price. After what is known as a Hey's or a Chopart's operation (leaving the heel and a part of the sole of the foot), the main idea is to make a presentable appearance with a cork-filled boot. In cases of higher amputation where an artificial ankle-joint is needed, it may take the form of a transverse rod working in a socket, or of two "rule joints," one on either side of the stump, the lateral yielding of a foot is sometimes imitated by side springs which yield to lateral pressure. One of the best substitutes for the real foot is a curved sole (Beaufort), where the movement has a natural appearance, though the substitute itself is somewhat unsightly. The simplest form of artificial foot is a peg at the end of a "bucket" which holds the stump. The center of the artificial ankle is often on the ball and socket joint principle. The artificial foot is sometimes extended by means of catgut strings fastened at the back of the knee, with flexible bands passing down over the upper surface of the foot. In Syme's operation (amputation below the knee) pressure can be borne on the extremity of the stump and the foot can be made to suit the purse and occupation of the patient. In amputations above the knee the weight can be borne either on the extremity or by a leather sheath. The simplest form of artificial hand is a leather sheath laced to the arm stump, and so fitted that a knife, fork or spoon can be screwed into it. Other hands open and close by hydraulic pressure. The Beaufort hand is of wood with a movable thumb. Prices of artificial limbs vary greatly; for instance an ordinary box leg, on which the cripple kneels with the stump pointing to the rear, can be had for about fifteen shillings, while a jointed mechanical leg may run up to as much as fifty guineas.

One of the greatest triumphs ever reported in this curious industry, however, is undoubtedly the mechanical face worn by a man whom Dr. Delair (a French doctor) exhibited recently to the members of the French Medical Academy. Owing to the accidental discharge of a fowling piece the whole lower portion of this man's face was destroyed and a portion of the tongue seriously damaged, but by a marvelous piece of mechanism the patient has had his appearance restored to him. The mechanism consists of four parts. In the first place, of a silver grooved case in which the lower row of artificial teeth are fixed, attached to a tin device containing the upper teeth; there is also a second part of indurated rubber and gold to hold the upper front teeth, the whole terminating in two small horn-like pegs shaped so as to hook into the nostrils. The third part consists of the chin and lower lip, which are made of special soft rubber painted in flesh tint in a most deceptive manner. The chin is also covered by a false beard. At the back of this portion there are several small screws which pass through holes in the tooth holders and thus join the chin and lip to the artificial upper jaw and palate. The fourth and last piece is the upper lip and nose, also made of flesh-tinted soft rubber and covered with a false moustache. Thanks to this skillful contrivance the man is able to speak and chew his food, while at a short distance it is impossible to discern that his face is not natural. The different parts have to be unscrewed once a day, and well washed with water and soap.

It is to be hoped now that airships are in the air some good genius will discover an artificial skull capable of withstanding bombs and shot dropped from the clouds.

A New Solvent for Compressed Acetylene

THE tank of compressed acetylene carried by autos for their lamps is safe enough because the gas is dissolved under pressure, in acetone. An attempt to compress the pure gas would result in an explosion, immediate or delayed, but violent. The search for a substitute for acetone has resulted in the recommendation that acetaldehyde be used. It is cheap and will become cheaper as it is made by the partial oxidation of grain alcohol, but it possesses other advantages.

In industrial practice eighty five ounces of acetone dissolves, as a rule, thirty seven ounces of acetylene at 70 deg. Fahr. and two hundred and fifty pounds pressure, while eighty two ounces of acetaldehyde have dissolved forty eight ounces of acetylene at 70 deg. Fahr. and two hundred and sixty five pounds. It is evident that acetaldehyde is the better solvent. It burns with a heat nearly as great as that of acetylene itself, and so in metal cutting or welding by the oxy-acetylene blow pipe it cools the flame very little. With acetone there is only an hour's warning before the gas gives out, but acetaldehyde develops a round, black spot in the flame five or six hours before exhaustion of the gas.

The Heavens in May

Motions of the So-called "Fixed" Stars

By Henry Norris Russell, Ph.D.

As we look out upon the constellations, which after a brief acquaintance become so familiar to us, we may be from year to year impressed with the utter absence of change in their outline. More exact study of the motions of the stars which compose them only deepens this impression, for we learn that no changes which would be at all conspicuous to the unaided eye have taken place in the appearance of any one of the star groups in our skies in the last three thousand years. But when we accustom our minds to a different time-scale, measuring the intervals between our imagined observations, not in years, or even centuries, but in hundreds of thousands of years, we come upon quite a different state of things.

It may seem bold to attempt to forecast at all what the heavens will look like a hundred thousand years from our era, but for the brighter stars their apparent motions have been so carefully observed that, if they continued to move over the heavens at the same apparent rate, their positions even at that very remote epoch, could be foretold accurately enough to make a very fair star map for naked-eye purposes (though many stars might be a degree or so out of place on it).

But for such long intervals of time we cannot safely assume that the apparent motions of the stars in the sky will be uniform. The stars are actually moving in straight lines at uniform speed. But from this very fact it is evident that any star must seem to us to move fastest in the sky when it is nearest us, and slower when it is in other portions of its track (both because it is then farther away and because its motion then makes an oblique angle with our line of sight instead of a right angle).

If a star is coming nearer to our system it should therefore appear to move over the celestial sphere with gradually increasing speed, and the opposite will be true if it is receding from us. This change in speed will be very slow, and will not become perceptible even to the most refined observations, until the star has moved over ten or fifteen minutes of arc. So far it has been detected by direct observation for only two stars of very large proper motion—Groombridge, 1830, and 61 Cygni. For both of these Prof. Boss finds that the apparent motion is gradually increasing in rapidity, from which it follows that these stars must be coming nearer our system, a result fully confirmed by direct spectroscopic observations.

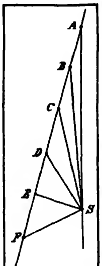
For many other stars, however, we may predict with confidence that similar changes in their "proper motions" will occur. If we know the parallax, i. e. the distance of a star, and have also measured with the spectroscope its velocity of approach or recession, we can easily make a diagram of its real path in space (using the sun as the center of reference) and thus predict all the circumstances of its motion.

For an example we may take the star Zeta Herculis. The observed parallax of this star, 0.14 second, shows that its present distance from us is about 1,400,000 times that of the sun. It appears to move across the sky at a rate of 0.61 second a year, which, at that distance, demands a real motion, at right angles to our line of sight, of 12½ miles a second. But, from the spectroscopic work of several observers it is found that it is approaching us at the unusually rapid rate of 47 miles per second. It follows that this star is actually moving at a rate of 49 miles a second in a line which makes an angle of only 15 degrees with the line joining it to the sun. At this rate it travels every year a distance equal to 16½ times that separating the earth from the sun.

We can now make a diagram of the track of this star past the sun, such as is shown in the adjacent figure, in which *S* denotes the sun, *A* the present position of the star and *B*, *C*, *D*, *E*, *F*, its future positions at intervals of 20,000 years.

A mere glance shows how much more rapidly this star will appear to be moving when it is nearest us (some 85,000 years hence) than it does now.

More detailed computation shows that at that time it will appear as bright as Arcturus does now, and have a "proper motion" of more than 9 seconds per year—greater than any star has at present. It will certainly be a remarkable object then, but can hardly retain its present name Zeta *Herculis*, for it will have moved northward and westward about 75 degrees into a region of the sky which is now assigned to the southern part of Ursa Major, and 100,000 years hence it will be in Leo.



Path of Zeta Herculis for 100,000 years.

This is a somewhat exceptional case, for the track of this star comes remarkably near the sun, and its motion is very rapid. But a majority of the stars now familiar to us will have got far away from their present stations by the end of a thousand centuries. Arcturus, for example, which is now almost at the nearest point of its path, though 2,750,000 times as far away from us as the sun, will then be almost half as far away again and appear about half as bright as now, while it will have moved some 40 degrees south westward in the heavens into the region now occupied by Corvus. Spica, on the other hand is a very remote and slowly moving star, and will in all that time have moved but 1½ degrees southwest of its present position. Antares, and most of its brilliant neighbors in Scorpio are even more remote, and will change their places by only a degree or so in all this time. Altair, on the contrary, is a near neighbor and is still approaching us, so that in the year 101,000 it will be within the present boundaries of Hercules, more than twice as near, and fully five times as bright as at present.

All this may seem like very long range speculation, but a hundred thousand years, however long historically, is but a very short time from the standpoint of geology, as all students of that science agree. It is, therefore, much more than probable that could we be transported back to but a relatively recent geological period, say half a million years ago, we would find, on regarding the heavens, little or nothing recognizable in the way of constellations or individual stars (except a few groups like the Pleiades). But at this time, the main features of the present land surface of the continent were not greatly different from what they are now, and so we see that the "eternal hills," perishable though they may be, are in all likelihood more lasting than the constellations, though very far from being as enduring as the stars.

The Heavens.

Turning to our map, we find upon it all the stars of which we have spoken. Arcturus is high in the south, seeming at first glance almost overhead. Spica is lower down, and to the right, and Scorpio is rising in the southeast. Hercules, with Corona above and Lyra below him, is east of the zenith, and Aquila, with its bright star Altair has just risen. Ophiuchus and Serpens fill the southeastern sky. Centaurus is low in the south, and Hydra in the southwest, with Leo, Virgo, Crater, and Corvus above it. Gemini and Auriga are setting in the west and northwest, and the Great Bear hangs high above them. Ursa Minor and Draco are above the pole, Cepheus and Cassiopeia low in the north, and Cygnus in the northeast.

The Planets.

Mercury is a morning star all through May, but is best observable at the beginning of the month, when he rises about 4.30 A. M. Being, however, south of the sun, he is not very favorably placed for us. Venus, having passed through conjunction with the sun on April 24th, is now a morning star, and rapidly moves out of the twilight. At the end of the month she reaches her greatest brilliancy, being about 11 times as bright as Sirius, and 120 times as bright as a standard first magnitude star. She rises about 3 A. M., and can be followed with the unaided eye long after the sun has risen.

Mars is likewise a morning star in Pisces, rising about 3 A. M. in the middle of the month.

Jupiter is in Sagittarius, and rises about 11 P. M. on the 15th. He is too far south to be well observable until some time after midnight.

Saturn is evening star at the beginning of the month, setting at 8.45 P. M., but the sun overtakes him and on the 28th the two bodies are in conjunction, and the planet unobservable.

Uranus is in Capricornus, observable in the hours before daybreak. Neptune is in Gemini, and is about four hours high at sunset.

The moon is new at 3 A. M. on the 6th, in her first quarter at 7 A. M. on the 13th, full at 3 A. M. on the 20th, and in her last quarter at 7 P. M. on the 27th. She is nearest the earth on the 15th, and remotest on the 28th. During the month she passes by Mars on the 2nd, Mercury and Venus on the 4th, Saturn on the 7th, Neptune on the 11th, Jupiter on the 23rd, Uranus on the 25th, and Mars again on the 31st.

Princeton University Observatory.

At 11 o'clock May 7.
At 10½ o'clock May 15.
At 10 o'clock May 22.

At 9 o'clock June 7.
At 8½ o'clock June 14.
At 8 o'clock June 22.

At 9½ o'clock May 30.

NIGHT SKY: MAY AND JUNE.

Water Softening Methods

Methods of water softening are not only of great practical value for preventing boiler scale, but are needed in dyeing, laundry and other branches of industry, as is well known. We wish to speak of the use of aluminium for this purpose. A European method consists in filtering the water upon the compound called "permutite," which is a double silicate of alumina and soda obtained by an industrial process. Contact with it causes the lime of the water to give soluble salts of soda by double decomposition, and the filtering matter is transformed to lime salt, this being renewed by a common salt treatment. Still more interesting is the new process which consists in allowing the water which is to be used in boilers to flow over a simple aluminium plate with embossed surface. It is said that such water will no longer give boiler scale, and it will even loosen up the scale already in the boiler. Such water should be used soon after the treatment or be kept in tanks painted inside. It is not known just what changes take place in the water, and perhaps the dissolved substances become ionized. As it is seen to be less oxidizing in its nature, no doubt the water has dissolved a certain amount of aluminium, which [illegible] of the dissolved oxygen, hence the lack of [illegible]

This picture shows a portion of the big battery of Packard trucks which plunged into the relief work of flood swept Dayton

THESE PACKARD TRUCKS HELPED TO PUT DAYTON BACK ON THE MAP

Following the Dayton flood, thirty-eight Packard trucks were used twenty-four hours a day to carry relief supplies and clean up the town

THE Citizens Relief Committee issued the call for help at noon March 29. Two hours later, eight Packard Trucks were loaded onto a special relief train at the Packard factory. Within twenty-four hours, these trucks were at work in Dayton. Ten other Packard trucks were sent by special train from Cincinnati. These vehicles, with the large battery of Packards owned by the National Cash Register Company, formed the backbone of the transportation outfit used in relief service.

Dayton streets were choked with wreckage and debris. With all other methods of transportation rendered useless, necessity demanded motor trucks and they made a magnificent response.

The Packard trucks worked in water so deep that it was necessary to cover the radiators to avoid flooding the engines. In the stress of continuous emergency work, the trucks received no mechanical attention. It was a situation that called for 100 per cent efficiency and the Packards met this demand

Sixteen hundred dead horses and many carcasses of other animals were removed by the Packard trucks within a period of three days. United States army officers say this prompt work averted an epidemic. Members of Dayton's Relief Committee state that the Packard trucks were a big factor in making the city fit for habitation

The people of Dayton know that when necessity calls the Packard delivers. What will you do when your test comes?

HEADQUARTERS
DAYTON MILITARY DISTRICT
DAYTON, OHIO

Dayton, Ohio, April 17, 1913.

Packard Motor Car Co.,
Detroit, Mich.

Gentlemen:

We are both pleased and grateful to report that during the past three weeks of most extraordinary service, Packard trucks have rendered invaluable and continuous service. The work has been continuous day and night over almost impassable streets.

Without motor trucks it would have been impossible to have distributed relief supplies.

Very truly yours,

Adjutant General

THE NATIONAL CASH REGISTER COMPANY

DAYTON, OHIO April 9, 1913

Mr Alvan Macauley,
General Manager, Packard Motor Car Co ,
Detroit, Mich

Dear Mr. Macauley;

Your letter of April 2nd is received, and I take the earliest opportunity of writing to thank you on behalf of the Dayton Citizens' Relief Committee for the excellent assistance rendered by the Packard Motor Car Co , in our time of stress

At the time we appealed to you motor trucks were our most pressing need, as we had the greatest difficulty in getting provisions for hungry people to the different points in the city for distribution Your promptness helped to save the situation

Sincerely yours,

John H Patterson

Ask the man who owns one

Packard Motor Trucks are in successful use in 169 lines of trade

PACKARD MOTOR CAR COMPANY, DETROIT


King of All Safety Devices
THE LIFE BOAT
THE LIFE PRESERVER
THE STEAM GAUGE
FIRE EXTINGUISHER
THE SAFETY HAMMERLESS REVOLVER
SAFETY VALVE
THE SEMAPHORE
THE SAFETY CLUTCH FOR ELEVATORS
THE FIRE ESCAPE
THE AIR BRAKE
THE AUTOMATIC COUPLER
THE RAILROAD GATE
THE STREET CAR FENDER
THE SAFETY RAZOR
THE SAFETY MATCH
THE PUL TOR
The Important Factor of Automobile Safety
All danger of skidding now eliminated. No longer a bugaboo to the motorist who takes the ordinary precaution of always carrying Weed Chains with him and putting them on when the roads and pavements are wet, slippery or greasy.
Many ships have gone to the bottom hence the necessity for "Life Preservers." Elevators have fallen time and time again so "Safety Dogs" are required. Fires have oft precluded escape by the regular exits and "Fire Escapes" are compulsory. And last *but not least* is the danger from the *SKIDDING* of an automobile that is quite as much of a terror to the experienced driver as it is to the novice.
To remind you of loss of life in connection with motoring is unpleasant, but if you have ever had a *narrow escape from a bad skid* you will agree that there are graver annoyances than this reminder. *There is only one way* by which skidding can be guarded against and absolutely prevented and that is by the use of
Weed Anti-Skid Chains
REAL LIFE INSURANCE—the kind that saves lives
Probably no other device has done so much to raise the factor of automobile safety as WEED CHAINS. They are the proverbial "ounce of prevention" against skidding—the cause of over nine tenths of all automobile accidents. *Life Insurance Companies* recommend their use to their policy holders. *Accident Companies* go so far as to strongly endorse and recommend them. *Taxicab Companies*, for their own protection, *insist* that their drivers put them on when the streets are wet or icy.
Perfect Control and Safe Comfortable Driving
through deep mud, treacherous sand or on slippery pavements can be had only by equipping all four wheels of your car with Weed Chains.
On the Rear Wheels—they insure traction and prevent skidding.
On the Front Wheels—they make steering easy and sure.
WEED CHAINS cannot injure tires because they creep—are easily put on in a jiffy without a jack or other tool.
If you haven't a set of WEED CHAINS or *if you have* a pair for the rear wheels only, get a full equipment now. Delay is dangerous. Stop in at your dealer and provide yourself with the kind of *Life Insurance that saves lives*.
WEED
Weed Chain Tire Grip Co., New York
Manufactured in Canada by
DOMINION CHAIN CO., Limited—137 McGill Street, Montreal, Can.
Weed
ANTI-SKID
Chains

The Smallest Automobile

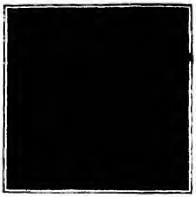
AN automobile which is probably the most diminutive practical working car in existence is illustrated in the accompanying photographs. It was designed and built by Joseph Newman of London and the little toy is driven and controlled entirely by his little son Freddy five years old who takes his little sister and brother for rides in it. Mr. Newman built the car with his own hands. It took eighteen months to complete the work. The car is equipped with a two-cylinder gasoline engine of 2½ inch bore and the engine is air-cooled with a fan. The power is transmitted by chain and belt to the rear axle. The starting gear consists of a foot lever which moves the belt from an idler to an active pulley. The mechanism is so constructed that when the youthful chauffeur takes his foot off the pedal the belt is moved to the idler and the brakes are applied. The car is equipped with electric lights supplied from a 4 volt accumulator. The miniature automobile is fitted with an exhaust whistle and is in every way the exact counterpart of larger automobiles. It will be observed that the car is provided with a top which may be brought forward when the weather is inclement.

A Black Walnut Burl

WEBSTER defines the word *burl* as an overgrown knot, or excrescence on a tree. These gnarled and warty excrescences, known also as burrs, are malformations of a considerable interest to the cabinet and furniture makers. On a recent visit to Mt. Vernon, Virginia, the writer photographed a remarkable excrescence on a walnut tree which is located just about 50 feet in front of Washington's tomb. By comparing the diameter of the trunk which is 15 inches four feet above the ground with that of the burl, it is seen that this is no small specimen of a burl. Though sometimes found larger, they rarely occur so high up on the branches and attain such an enormous size as this one. Most of them are on the main trunk of the trees and occupy a space equal to one half the diameter of the tree. This peculiar growth is sometimes caused by a fungus, which attacks the cambium or growing tissue and results in an abnormal development. The walnut tree is frequently attacked by this fungus and some specimens may be found with a number of burls. It may also be due to some mechanical injury to the cortex, or at other times to the sudden exposure of a previously shaded tree to the light, as in the case where neighboring trees are removed. From this peculiar growth is obtained the most beautiful grained wood for cabinet work. Although the wood is more difficult to work, yet the beautiful variegated colors, bird's eye markings and graceful wavy grain far surpass those of any other wood in intricate design and color.

Pumping Out Flooded Cellars With a Motor Fire Engine.

AFTER the recent Ohio floods subsided even though the surface was drained of water there yet remained considerable work to be done in pumping out cellars. For this purpose, wherever possible fire engines were used. The accompanying photograph shows a gasoline pumping engine at work at Columbus Ohio drawing water out of the cellar of engine house No. 10. This sort of work put the fire pump to a severe test, for the water was muddy and sandy. However the pump shown in the illustration is of the multiple stage centrifugal type and was in no way injured by the grit sucked in with the water. The pump could draw in stones as large as three quarters of an inch in diameter without injury to any of its parts. The pump is driven by a six cylinder engine of 114 horse power capacity and it will deliver 1,000 gallons per minute at 120 pounds of pressure. At a recent test it drew water six and one half feet pumping 1,280 gallons per minute, at 120 pounds pump pressure through three lines of 2½-inch hose, 100 feet in length, with a 1¼-inch smooth bore nozzle on each line. The test lasted twenty minutes. The engine makes 750 revolutions per minute and it drives the pump at 1,500 revolutions per minute.



Just like grown folks.

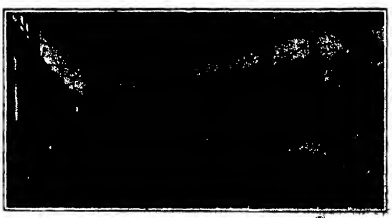
Underside of the baby auto.

Immense burl on a walnut tree.

Sawing down a tree single handed.

A six-ton truck hauling a twenty-three-ton boiler

Pumping out a flooded cellar with a motor fire engine.



Utilizing power developed by testing tractors.

Guide for a Lumberman's Saw

IN order to enable a lumberman to use a two-handled saw without the aid of a second man, a Canadian has devised the guide shown in the accompanying illustration. A pair of tongs are provided which may be clamped to the tree, the jaws of the tongs being formed with teeth adapted to dig into the bark of the tree. The handles of the tongs pass through sockets formed in a guide bar to which they are made fast by means of a pair of thumb screws. The saw rests on a carriage that is adapted to travel along the guide bar as the saw is fed into the wood. A constant tension is provided by a weight on the end of a chain that passes over a pulley at one end of the guide bar and is attached to the carriage. With this arrangement the lumberman operates the saw from one end while the other is supported by and is free to slide in the carriage. A twenty ounce weight or if preferred, a heavy clock spring is sufficient to feed the saw into the tree. With this arrangement a man may corner or notch a tree and can use wedges. A tree of any size may thus be cut down single handed.

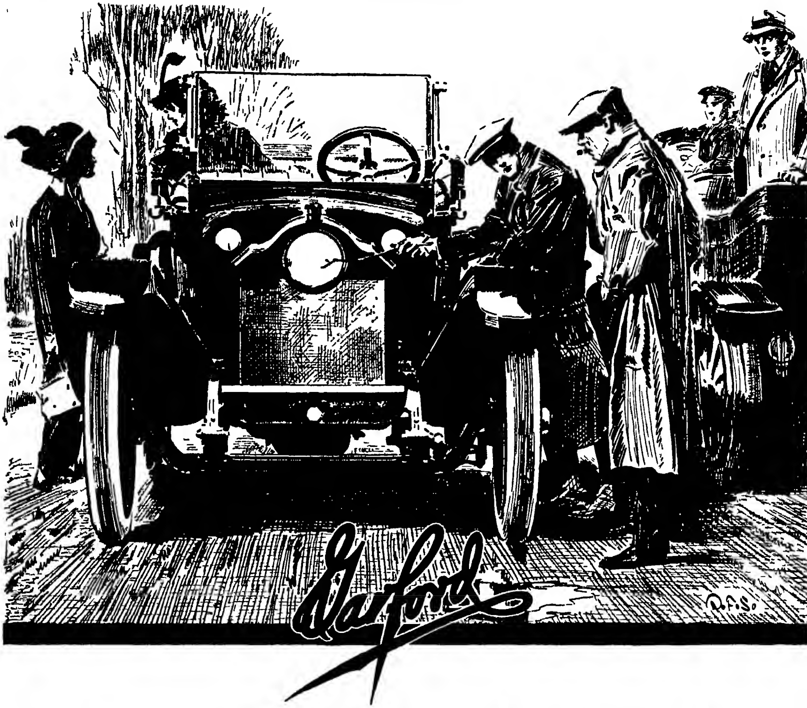
Hauling Forty-five Tons With a Six-Ton Truck

IN the earlier days of motor trucking, a truck capable of carrying its load with a reasonable degree of reliability and economy was thought to be doing very well indeed and nothing better was asked of it. While even to-day there are motor trucks that are rather hard pressed to fulfill these conditions, it may be said that the majority of machines are capable of doing a little better than might be expected from the normal rating. A case in point is that of a six-ton truck with hydraulic transmission of power which recently made a very heavy haul with success. The accompanying illustration shows the truck and its trailer for the time being—a huge contractor's truck weighing, without load, 12½ tons and loaded with a boiler weighing 23 tons the total trailer load being 35½ tons. The motor truck, weighing 1½ tons, was loaded with 6 tons of boiler fittings, etc., and the entire weight of 45 tons was moved up-town through the streets of New York, from Nineteenth Street to Sixty-eighth Street, at the rate of about 4 miles an hour, without difficulty either in handling the great weight or in controlling the machine and the trailer. Several grades, severe when the load is considered, were negotiated. In order to handle this piece of work in the usual way about twenty horses would have been required, making a very long, awkward procession and blocking cross-street traffic considerably. The time in transit would have been several times greater than was taken by the machine and the damage to the pavement would have been greater owing to the slower speed and, consequently, the longer time the crushing weight would have been on the road.

Obtaining Power from a Testing Plant

THE manufacturer of engines of any type, in the nature of the case, makes a thorough test of each one before it goes to the user. This is especially true of gas engines of any sort. Parts must be "smoothed up" and numerous adjustments made. The various devices such as magnetos, coils and others must be tested under hard service conditions. If the test is made directly on the Prony or water brake all the fuel is lost. Realizing this, an enterprising company manufacturing tractors, has used its machines

(Continued on page 413.)


Garford

The Shoes You Wear

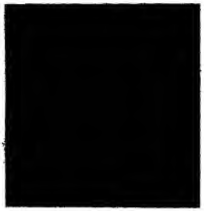
Why They are Moderate in Price and Good in Quality

By George Brockholst

The Goodyear welter, which has been the leading factor in revolutionizing shoemaking and which has done much to reduce the price of shoes.

This lasting machine is provided with wipers for toe and heel, which draw the leather from all directions so that no wrinkles show on the shoe.

A rounding and channelling machine is employed in cutting the outsole to conform with the shape of the bottom of the last with any desired extensions.



Goodyear improved sole-laying machine, which fastens the cemented soles to the shoe-bottom without tacks so as to leave a clean bottom.

The first fact that everyone should know about shoes is this

SHOES ARE BETTER IN QUALITY NOW THAN THEY EVER WERE AND VERY NEARLY AS CHEAP Every other necessity of life has increased much more in cost

Another fact

SHOES ARE NOT MADE BY A TRUST No less than 1,200 factories are keenly competing with one another

There must be some reason why shoes have not increased very much in price and why there is no shoe trust

There is just one and only one reason and that is THE EFFECTIVE SERVICE POLICY OF THE UNITED SHOE MACHINERY COMPANY

HOW THE UNITED SHOE MACHINERY COMPANY WAS STARTED

The United Shoe Machinery Company was organized in 1899 It was formed for the purpose of enabling shoe manufacturers *to make better shoes* than they made before and *to sell them to the public at the smallest possible expense*

Before the United Shoe Machinery Company was organized three important companies were supplying manufacturers with shoe machinery THE COMPANIES WERE NOT COMPETITORS because each made a class of machines for a special purpose

Thus the Goodyear Shoe Machinery Company made machines which produced what are known as "welt" shoes, like those once sewn by hand In sewing a shoe by hand a thin and narrow strip of leather called a "welt" is first stitched to the insole and upper The heavy outsole is then sewed to this welt *so that the stitches fall* outside and do not touch the foot the insole being left entirely smooth The welting and stitching machines of the Goodyear Company named after Charles Goodyear, who developed the original invention and who was a son of the inventor of the Goodyear rubber vulcanizing process—completely displaced hand sewing The welt shoe made on the Goodyear machines is the most *comfortable* shoe sold *to-day—the finest* product of the American shoe industry

Besides the Goodyear Shoe Machinery Company, there were in the field the Consolidated and McKay Lasting Machine Company and the McKay Shoe Machinery Company The Consolidated and McKay Lasting Machine Company made machines for lasting a shoe, a totally different operation from that performed by the Goodyear machines. The McKay Shoe Machinery Company made machines for attaching soles and heels by metallic fasteners.

These three companies did not sell their machines to shoe manufacturers, but leased them and charged a royalty for their use So long as the machines were in use they earned money for their manufacturers and for shoe makers. It was very necessary that they should *not* remain idle *for* a long time Hence each of these companies established a repair service to keep its leased machines in good running order

Here were three NON-COMPETING companies dealing with the same shoe manufacturers and sending out three sets of repair men to the same factories. Clearly, there was an unnecessary duplication of expense, for all of which the shoe manufacturer and *ultimately the public paid* One set of repair men could easily keep all the machines of the three companies in order One factory could easily make all three NON-COMPETING types of machines, so that the shoe manufacturer could obtain his equipment from one source just as housewives can obtain non-competing carpet sweepers and gloves or non-competing washboards and linen from a single department store.

This reproduction of an ancient decoration shows that, thousands of years ago, the Egyptian made shoes very much as the modern cobbler did before the invention of American shoe machinery

From Dooley's "Manual of Shoemaking" by courtesy of Little, Brown & Co.

An interval of thousands of years separates this picture from the Egyptian hieroglyphics above. Yet the method of shoemaking disclosed is the same. More progress has been made in the last generation, because of the systematic development of machinery in this country, than in the preceding fifty centuries.

So, in order to lessen the expense of making shoes AND IN ORDER TO ENABLE THE PUBLIC TO BUY THE BEST SHOES AT THE LOWEST PRICE the three NON-COMPETING firms mentioned were consolidated in 1899 to form the United Shoe Machinery Company

THE BENEFITS OF THE LEASING SYSTEM.

Because the old leasing system has been continued by the United Shoe Machinery Company *there is no shoe trust* You will understand why if you consider the way most manufacturers must start in business.

Suppose that you had decided to engage in a manufacturing enterprise You would have to raise money not only for the purpose of acquiring a factory, but also of purchasing machinery Indeed, you would spend much money on machinery—so much that when you sold your goods, you would have to make a proportional charge for the interest on the money invested in the machinery—about six per cent a year—and another ten per cent a year for depreciation, repairs and the like Because these fixed charges are large, because it takes much money to buy expensive machinery, *many important industries*—textile manufacturing, for example—*are concentrated in the hands of a few companies* COMPETITION IS LIMITED.

This applies to nearly every industry EXCEPT SHOE MANUFACTURING The United Shoe Machinery Company's leasing method renders it possible to obtain the most modern equipment for a small outlay so that the manufacturer can use his money over and over again in buying raw material and selling shoes. *He does not have to make a charge for interest on money invested in shoe machinery or for the depreciation of the machinery*

THAT IS ONE OF THE CHIEF REASONS WHY YOUR SHOES ARE SO CHEAP THAT IS ONE OF THE CHIEF REASONS WHY THERE IS NO SHOE TRUST

THE SHOE MANUFACTURER PAYS ONLY FOR THE WORK THE MACHINE DOES, just as he pays only for the work that a man does.

WHY THERE IS NO SHOE TRUST.

THE UNITED SHOE MACHINERY COMPANY DEALS WITH ALL SHOE MANUFACTURERS ALIKE. It matters not whether a man has a capital of a million dollars or only ten thousand dollars.

Big shoe manufacturers have tried to obtain what they call "better terms" from the United Shoe Machinery Company, because they use so much more machinery than the small manufacturer. If the United Shoe Machinery Company had listened to this argument there would be only a few large factories engaged in shoe manufacturing to-day, AND NO SMALL FACTORIES. *As it is, the man with only a few thousand dollars capital is able to compete with the millionaire.*

THAT IS ANOTHER REASON WHY THERE IS NO SHOE TRUST.

ONE AND ONE-THIRD CENTS A PAIR.

Of the three [illegible]

Here is a table of royalties per pair paid by shoe manufacturers who lease machines—

Goodyear welts, men's work . .	$0.05004
Goodyear welts, women's work .	0.04094
Goodyear turn shoes, women's and misses'	0.005
Men's and women's McKay shoes . .	0.01746
Children's McKay sewed shoes . .	0.01391

The average royalty received, based on the foregoing table, is about two and two thirds cents per pair. In reality IT IS LESS THAN EVEN ONE AND ONE THIRD CENTS A PAIR for most of the shoes worn, because Goodyear welt shoes constitute less than one third the annual production of the United States.

SINCE THE ORGANIZATION OF THE COMPANY THE SAVING IN COST OF PRODUCTION OF MEN'S GOODYEAR WELT SHOES EFFECTED BY NEW AND IMPROVED MACHINES AND LOWER ROYALTIES HAS BEEN NEARLY 9 CENTS OR NEARLY DOUBLE THE TOTAL ROYALTY NOW PAID.

In return for this trifling royalty, the United Shoe Machinery Company provides American shoe manufacturers with *a service that is unrivaled and unique.* This service means the assumption of the whole cost of invention, experimental work, development, manufacture and depreciation of machines, the cost of ceaseless care of machines to keep them at the highest point of efficiency, the purchase of patents and the cost of administration. President Winslow of the United Shoe Machinery Company has repeatedly said "IT ASSUMES ITEMS OF EXPENSE AND RISK WHICH, UNDER ANY OTHER SYSTEM YET SUGGESTED, THE SHOE MANUFACTURER WOULD BE COMPELLED TO ASSUME HIMSELF, THUS SUBJECTING HIS BUSINESS TO A GREATER MACHINERY COST PER PAIR THAN THE AVERAGE ROYALTY HE NOW PAYS."

Is it any wonder that shoes are so cheap?

KEEPING SHOE MACHINERY UP TO DATE.

Nearly all the modern machines to be found in the bottoming department of a shoe factory were either invented or perfected by the United Shoe Machinery Company. Some of them were invented by outside inventors who were not connected with the United Shoe Machinery Company, but who sold their patents to the United Shoe Machinery Company at a fair price. But most of them were *deliberately created* by a highly paid staff, to meet the needs of shoe manufacturing. No really good mechanical idea is lost or abandoned for lack of mental or financial support. FROM $500,000 TO $900,000 A YEAR ARE SPENT IN IMPROVING OLD MACHINES OR DEVISING NEW MACHINES.

If the inventors of the United Shoe Machinery Company are once convinced that some step in the making of a shoe can be accomplished in a simpler, cheaper and speedier way, all the resources of the company are placed at their disposal.

It used to be the practice, for example, to fit the parts of a shoe upper to the wooden last by hand. This operation was expensive. It required so much skill and patience that few thought it possible to carry it out by machine. Finally the lasting machine was invented which cared for a part of this operation. It was still necessary, however, by means of pincers to pull the leather over the nicer curves of the last before tacking it in place, and the inventors of the United Shoe Machinery Company were confronted with the problem of contriving a "pulling over" machine. This problem was solved by them at a tremendous cost. They worked for years and they spent over one million dollars. When they had at last finished their task the famous "Rex pulling over" machine was produced. *Despite all the time, all the money, that was expended on this machine, the shoe manufacturer pays a royalty of only three eighths of a cent for each pair of shoes made by its means,* and this small royalty also covers the use of several other machines used in the pulling over process.

IT IS THIS POLICY OF CONSTANTLY IMPROVING MACHINERY THAT HAS KEPT THE PRICE OF SHOES DOWN.

SCRAPPING MACHINES.

Many manufacturers in other industries CANNOT AFFORD TO DISCARD OBSOLETE MACHINES. They have invested too much money in them. Their manufacturing costs are often high because their equipment is out of date.

Every new invention produced by the United Shoe Machinery Company means the "scrapping" of hundreds of machines at the United Shoe Machinery Company's expense.

The "Rex" pulling-over machine, which was developed at a cost of over $1,000,000, and which fits the parts of the shoe upper correctly to the last

In a single year no less than four thousand machines have been withdrawn to make room for machines embodying the latest improvements. It does not matter if the shoe factory is large or small. All factories receive the latest improved machines. United shoe service is rendered to all on equal terms.

THAT IS STILL ANOTHER REASON WHY THERE IS NO SHOE TRUST.

THAT IS WHY EVERY SHOE FACTORY IN THE UNITED STATES, LARGE OR SMALL, ALWAYS HAS AN EQUIPMENT ABSOLUTELY MODERN—THE LAST WORD IN MECHANICAL INGENUITY.

THAT IS WHY THE PUBLIC IS ABLE TO BUY SHOES WHICH ARE CONCEDED TO BE THE BEST IN THE WORLD, AT A PRICE TO MEET EVERY PURSE.

THE REPAIR SERVICE.

Whenever a shoe machine is disabled the telephone or the telegraph will bring the nearest United Shoe Machinery expert to the shoe factory. Machines are thus maintained in perfect condition without charge.

Over five hundred repair experts are kept constantly on duty at the beck and call of shoe manufacturers. This expert service means that 100,000 catalogued machine parts must always be kept in stock in the Beverly plant of the United Shoe Machinery Company. Over twenty-one million parts of machines are sent out from the stock room annually to various branches of the United Shoe Machinery Company.

AS A RESULT OF THIS REPAIR SERVICE EVERY SHOE MANUFACTURER CAN COUNT ON HIS MACHINERY, AND HENCE ON HIS PRODUCTION. His profits are assured.

THERE IS NO MONOPOLY

THE UNITED SHOE MACHINERY COMPANY DOES NOT MANUFACTURE OR CONTROL *ALL* THE MACHINERY USED IN SHOE MAKING. Its service is confined largely to supplying the machines for lasting and bottoming shoes. In most factories machines for stitching, treeing or finishing shoes, and for working sole leather can be found which were supplied by other companies, and which are installed side by side with United shoe machinery.

No shoe manufacturer need deal with the United Shoe Machinery Company if he does not choose to do so. He can equip his entire factory with machines which are not made by the United Shoe Machinery Company. If, therefore, the United shoe equipment is to be found in nearly all the 1,200 shoe factories in this country it must be because it is so highly efficient, and because the manufacturer obtains not merely machines, but SERVICE—a service that enables him to fulfill his contracts to the day and TO SELL SHOES TO THE PUBLIC AT A LOW PRICE AND A SMALL MARGIN OF PROFIT.

The only monopoly which the United Shoe Machinery Company enjoys is the legal monopoly granted by the patent laws of this country to every inventor. Any one who takes out a patent enjoys exactly the same kind of a monopoly. After the expiration of seventeen years—the term for which patents are granted in this country—any one is free to make, use, and sell the invention disclosed in the patent.

The patents on many United shoe machines have expired. Others are free to appropriate the ideas disclosed in them, and others have done so.

The existence and success of the United Shoe Machinery Company depend not only on effective service, but also on the invention of new shoe machines, which will improve factory methods and which will improve the quality of shoes and keep the price down.

HOW THE SHOE INDUSTRY HAS PROSPERED

The liberal business policy of the United Shoe Machinery Company has made shoe manufacturing one of the leading industries in this country.

Before 1899, when the United Shoe Machinery Company was formed, the products of American shoe factories were worth $258,000,000. Ten years later they were worth $442,000,000—*an increase of seventy per cent.*

THE WAGES of those employed in American shoe factories INCREASED FIFTY SIX PER CENT between 1899 and 1909, or from $59,170,000 to $92,159,000.

Our shoe exports were very small in 1899. They amounted to only $1,816,538. In 1912 the value of imported shoes was $17,480,634—*an increase of more than 850 per cent.*

This wonderful growth is due chiefly to the liberal business methods and the factory service policy of the United Shoe Machinery Company. The wealth of this country has been increased by millions because the United Shoe Machinery Company has systematically invented new machinery to lessen the cost of shoe manufacture and to improve the quality of shoes. AS A RESULT, THE SHOE INDUSTRY OF THE UNITED STATES LEADS THE WORLD.

SHOES ARE NO LONGER LUXURIES.

Nowadays everybody wears shoes. Yet there was a time within memory when shoes were luxuries. A pair of handsewed welt shoes once cost from $10.00 to $16.00. Only the rich wore them every day. Yet now you pay from $3.50 to $5.00 for a pair of Goodyear welt shoes, much more comfortable and much better in quality than the $10.00 handsewed shoe your father or your grandfather wore. What is more, *you, as an average American, buy three pairs of shoes a year.* Shoes are no longer a luxury.

JUDGE FOR YOURSELF HOW MUCH OF ALL THIS IS DUE TO THE POLICY OF THE UNITED SHOE MACHINERY COMPANY.

Advertisement

[illegible]

Part of a [illegible] two thousand types of shoe machines are pre[illegible] which [illegible] but which have been superseded by better types. [illegible] have been "scrapped" in a year by the United Shoe Machinery [illegible] for more efficient types.

A loose nailing machine. This apparatus is used in fastening the "heel seat" of the shoe preparatory to attaching the heel.

Notes for Inventors

Film for Moving-picture Machine.—George W Bingham of Brooklyn, N Y, assignor to Bingham-Cameron Company of New York has patented No. 1 045 502, a film for moving-picture machines which comprises a disk of celluloid or like transparent material provided with a series of pictures arranged progressively on the disk, the disk having an opening located in advance of the series of pictures and of sufficient size to permit free passage of the beam of light emanating from the projection apparatus of the machine.

The Patents of the Bath Trust.—The patents owned by the Bath Trust recently dissolved by order of the Supreme Court of the United States cover principally enameling processes The major patent of the trust was that granted September 26th 1899 to James Arrott Jr Prior to his invention the enameling powder was applied by a sieve attached to a long handle which was held by the workman with one hand and the sieve made to vibrate by the workman striking the handle with the other hand thereby sifting the powder over the surface of the iron ware The instrument was an imperfect one not easily handled, and by its use the workmen were subjected to intense heat and physical strain Besides the flow of the powder was not continuous it was cast upon the metal in intermittent puffs causing in many instances an unequal distribution of the powder and producing defective articles which either had to be thrown away or sold as seconds With Arrott s invention these evil results are lessened or disappear The sieve is mechanically vibrated very rapidly causing instead of an intermittent flow of the powder as in the hand process a practically continuous flow Both hands of the workman may be used to guide and direct the sieve The advantages of the instrument over the hand process are decided It is more efficient and more economical It makes a better article and in less time There is no waste in seconds The workman is relieved to some extent from the fierce heat Other patents owned by the Bath Trust are those granted to E Dithridge for a pneumatic sieve and a patent to William Lindsay for an enameling powder distributor These are improvements on the Arrott invention

Protecting Moving Picture Films—In a patent No 1 042 801 Isidor Kitsee the Philadelphia inventor suggests that he has found that if a nitrated material is embedded in a carbonate compound the gases given off by said material are neutralized the temperature remains stationary and no deterioration is ascertainable When two films each inclosed in a receptacle are subjected to a higher temperature one film embedded in a carbonate the other film minus the carbonate then the film without the carbonate will inflame at a far lower temperature than the film embedded in the carbonate for the reason that the gaseous products of the film embedded in the carbonate are neutralized as soon as they are given off whereas the gaseous products of the other film tend to raise the temperature and explode To protect therefore a film used for kinematographic exhibition he embeds the same in a carbonate of ammonium compound such for instance as a bi-carbonate of ammonium sodium etc and the container for the storage of films has a lining impregnated with a neutralizing agent for the gases given off by the film

A Running Support for Flying Machines—Michael A Parisano of New York city in a patent No 1 049,591, shows a flying machine with trucks pivotally mounted on opposite sides of the main frame so they can swing transversely and having wheels at their opposite ends and springs connected with the trucks on opposite sides of their pivotal points.

A Convertible Tank Vessel.—A novel construction of convertible freighter and tank vessel is shown in the patent, No. 1 049,490, to Charles F. M. [illegible] of New York city and includes a ship's hull and a number of removable cylindrical tanks which are placed vertically in the hold so they can be raised [illegible] therein and adjustable means are provided for connecting the tanks together and to the sides of the hold.

Resignations from the Patent Office Examining Corps—Notwithstanding the increase in salary accorded the assistant examiners of the U S Patent Office resignations still continue frequent and during the past year the examining corps has suffered by twenty-four resignations One of these was a principal examiner During the same period several members of the corps have died including one principal examiner

Preventing Thumb Sucking—Jessie May Mitchell of Clayton Miss has procured a patent No 1 048 569 for a thumb and finger-sucking preventer in which there is a stall fitted on the thumb or finger and a round disk too large to be inserted in the mouth is held by the stall on the end of the thumb or finger so the latter cannot be put in the mouth

Vermin Trap—A patent No 1 048 479 the invention of Joseph Andel of Chicago Ill has issued for a vermin trap in which a hollow body has perforated walls and a honeycombed structure within the body for the reception of vermin and the perforated end walls are controlled by slides which have openings registrable with the openings and movable so the slides can be adjusted to close the wall openings

A Trap Set by Foot—Maurice F Richardson of Southington Conn has secured a patent No 1 048 586 for a spring trap which has a pan and a latch to hold the jaws open and is provided with lateral foot engaging extensions at the opposite sides of the jaws so that the trap can be set by the feet pressing upon the extensions

An Improved Beehive—Francis Danzenbaker of Norfolk Va a well known inventor of beehive improvements as assignor to Robert Johnson has secured patent No 1 048 950 for a beehive the body of which has a ledge for supporting frames or holders and a filling rail for the spaces above the ledge and provides a strip of treated material between the filling rail and the adjacent hive members

An Electric Rat Trap—Michal Morawiecki of Pittsburgh Pa has secured a patent No 1 048 995 for an electric rat trap which has a tilting platform and a pair of electrodes below the normal plane of the platform with the free opposing ends of the electrodes spaced apart and forming a mouth and operating to control and cooperate with the tilting platform

A Novel Form of Brake Head—Frederick R Cornwall of St Louis assignor to Chicago Railway Equipment Company has secured a patent No 1 045 261 for a brake head which has an opening of such size as to permit the introduction of the brake beam with overlying means for securing the brake beam in order to hold the head on the beam in suitable adjustment

A Gas-chain Fixture—Frederick DeWitt Pitcher of Rochester N Y assignor to Welsbach Light Company in patent No 1 046 489 shows a gas-chain fixture in which the gas-supply pipe extends adjacent to the links with its ends extending into socket members provided on the end links of the chain and connected thereto so that suitable connections may be made with said socket members to communicate with the gas-supply pipe carried by the chain

Heating Hosiery Electrically—The General Electric Company as assignor of Frederick M Vogel of Pittsfield Mass, has secured patent No 1 046 514 for a device for drying hosiery in which there is an electrically heated metallic form corresponding generally to the shape of a stocking and having interchangeable toe portions with a resistance conductor extending into the form and the toe portions so that the form may be heated throughout

Horseshoes by Centrifugal Casting.—Reasoning from the dental practice of taking impressions of cavities and then casting by the aid of centrifugal action fillings to fit the cavity, the writer heard it suggested recently that some one might invent a means of producing well fitting and suitable horseshoes by taking impressions of the prepared hoof and then casting in a [illegible] [illegible] the hoof.

Trade-mark Notes

"Ritemse" Held Registrable Trade-mark for Knit Goods—Mr Commissioner Moore in *ex parte* Ritemse Underwear Company has held the word "ritemse" as applied to underwear is not descriptive of such goods and is registrable as a trade-mark therefor In the decision the Commissioner says "in the case of underwear however, there can be no particular size which could be described as "ritesize" whether this expression is considered to refer to absolute size or to the proportion of one part to another since there is no given size or proportion in underwear which could be considered a right size any more than any other"

"Brilliant" Not Registrable for Flour—In the case of Sauers Milling Company v Kehloe Flour Mills Company the Court of Appeals of the District of Columbia in holding that the word "Brilliant" as applied to flour is descriptive and not registrable as a trade-mark for flour said "The testimony shows that it indicates bright flour that shows up well and is of a superior quality as distinguished from the darker brands and that the bright flour is considered of greater value and more sought after by purchasers than the darker brands"

Chamber of Commerce in its Relation to Patents, Trade-marks and Copyrights—The Chamber of Commerce of the United States of America with general offices in the Riggs Building at Washington D C has appointed its committee on patents trade marks and copyrights in several groups located at Rochester N Y Detroit Mich and Washington D C The groups have individual chairmen and are composed of follows

Rochester N Y

James G Cutler Rochester N Y chairman (President Alliance Bank President Cutler Mail Chute Company and Realty Company)
George Eastman (President of the Eastman Kodak Company)
Henry W Morgan (University Avenue Rochester N Y Vice-president and General Manager Morgan Machine Company box making machinery and nailing machines)
George W Todd (G W Todd & Co manufacturers of protectographs Rochester N Y)
Edward G Miner (President and General Manager the Pfaudler Company Rochester N Y)

Detroit Mich

James Whittemore Detroit Mich chairman (Patent Attorney Whittemore Hulbert & Whittemore Wayne County Savings Bank Building Detroit)
John Trix Detroit Mich (President American Injector Company)
Henry M Leland Detroit Mich (President Cadillac Motor Car Company)
Howard E Coffin Detroit Mich (Vice-president Hudson Motor Car Company)
C A Strelinger Detroit Mich (Dealer in machinery supplies the Charles A Strelinger Company)

Washington D C

C Mills Spear 9th and Grant Place chairman (Former Commissioner of Patents and well known patent attorney)
W W Kendall Meadville Pa President the Spirella Company
Percy B Turpin (625 F Street Washington D C Represents SCIENTIFIC AMERICAN also Munn & Co)
Joseph R Edson (Washington Loan and Trust Building Washington D C patent attorney)
William G Henderson (801 F Street Washington D C patent attorney)

It is not the purpose of the Chamber of Commerce to have one general committee but rather to have each group consider the subjects and reach its conclusion and possibly correspond with the other groups with a view to securing reports from the several groups which instead of being sectional will be in a way national and at the same time give recognition to the different viewpoints of the various sections of the country in which the groups are located

A Trade-mark Decision.—In deciding the case of *ex parte* Callahan & Sons First Assistant Commissioner of Patents Billings in holding that a combination of non-registrable words is not registrable, quotes the answer of the Examiner of Trade-marks, stating that he has correctly stated the law relating to this type of marks. In his statement the Examiner of Trade-marks says "It is true that a [illegible] distinctively displayed is registrable [illegible] displayed are not registrable," and refers to the decision of the Court of Appeals of the District of Columbia *in re* Meyer Brothers Coffee and Spice Company as directly ruling that the combination of non-registrable words does not produce a registrable mark

Legal Notes

High-tension Insulator Case.—In the interference case of Hewlett v Steinberger involving an important feature of high-tension insulators and referred to in the SCIENTIFIC AMERICAN of April 19th the Court of Appeals of the District of Columbia has rendered a decision affirming the award of priority to Steinberger

Designs Must Involve Invention—Mr Commissioner Moore in the case of *ex parte* Mygatt has held that in order that a design be patentable it must not only be new and ornamental but there must have been an exercise of the inventive faculty in its production citing the Court of Appeals case of *in re* Schraubstadter, 26 App D C 331

Adjudication of Cracker Package Patent.—In Peters v Chicago Biscuit Company *et al* in 200 Fed Rep 774 the District Court N D Illinois E D speaking by Justice Kohlsaat Circuit Judge has held that the Peters patent No 621 974 for a method of and means for packing biscuits, crackers and the like the package consisting of a carton having an interfold lining of wax or paraffin paper to exclude the dust and moisture is void for lack of patentable novelty in view of the prior art The court refers to the object sought being the approximate exclusion of air moisture dirt and insects and to this end being in practice further accomplished by complainant's exclusive licensee the National Biscuit Company by the use of an outer sealed wrapper or envelop entirely inclosing the package and contents which wrapper the patentee asserts is mainly for advertising purposes by the licensee

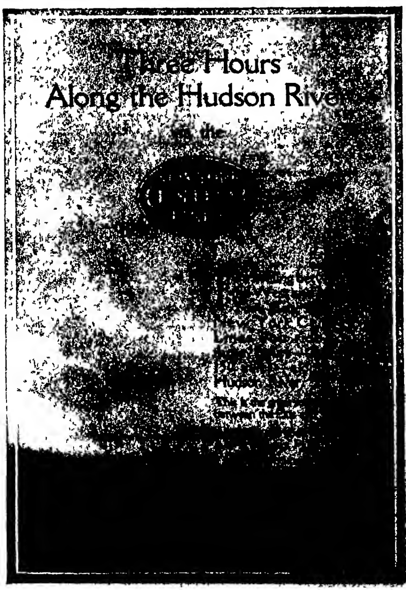
Outstanding Licenses Disregarded in Issuing Patents—In *ex parte* Dudley the Commissioner of Patents has decided that

"It results therefore in issuing either original or reissue patents grantees of interests therein shall not be considered to be other than assignees because of any outstanding licenses or licenses whether exclusive or not and the patents shall issue to the same parties as they would if such licenses did not exist"

The question arose in connection with the issue of a reissue patent the Revised Statutes specifically pointing out to whom reissue patents shall be granted whereas original patents are issued under the general provisions of the statute which leaves it discretionary with the Commissioner whether the patent shall issue to the inventor or the assignee

Decision in Interference Case—Assistant Commissioner Tennant in Bump v Reasoner has decided that where in an interference involving an application and a patent the applicant filed a concession of priority to the patentee judgment rendered upon this concession will not be set aside upon an allegation that the applicant was deceived as to duration of a license granted by a patentee It appears from the statement of the case that a party acting on behalf of Bump obtained from Reasoner an assignment of his right title and interest in the patent involved and that Bump was informed that a license had been granted but understood that the license was for but a year and had expired whereas it seems the license has not expired

Intervening Rights in Reissue Applications—Assistant Commissioner Tennant in the case of Perkins & Requa v Weeks holds that where in an interference involving an application for a reissue of a patent, a motion is brought to dissolve upon the ground that intervening rights accrued in favor of the opposing party by the issuance of a patent between the date of the original patent and the date of filing the application for reissue, such motion was properly refused transmission, since the mere grant of a patent between the issuance of an original patent and the filing of application for reissue thereof does not constitute intervening rights.



How Patented Inventions Have Increased the National Wealth

IN these days when great industrial dragons of capital guard every door of business opportunity, it is grateful to know that there is one open sesame left.

During the past spring, after a bill was introduced to restrict the rights of inventors in their inventions, Congress had the opportunity of hearing from the largest corset manufacturer in the United States, the biggest manufacturer of carpet sweepers, the best-known manufacturer of inexpensive watches, the manufacturer of the most advertised alarm clock in America, the two best-known safety razor manufacturers in the country, the largest manufacturer of cameras and photographic supplies in the world, all the phonograph and talking machine manufacturers in the United States, and most of the manufacturers of the specialties that newspaper and magazine advertising have made household words. Besides these, Congress also heard from the leading inventors of the country, the members of the Inventors' Guild, most of the engineering and electrical and commercial associations, and, finally, from Mr Thomas A Edison himself.

What these men had to say about the calamities which would follow if the rights of inventors were restricted so astonished the Committee on Patents, that the Committee decided not to press this Bill for the present For all that, it will probably be presented at the coming session, for which reason its objectionable provisions should not be lost to view

These manufacturers and inventors all told one story to-day invention, protected by patent, is in all commercial activities the chief, and often the only way by which business independence may be attained

All this explains why Americans lead the world in invention, why the patents taken out in the United States average nearly 40,000 a year and now aggregate nearly 1,100,000, and why the patents issued by the United States are nearly equal, in annual output and in aggregate amount, to all the patents issued by Great Britain, Germany and France combined Laid end to end, the patents which have been issued by the United States Patent Office would reach three times around the world Placed in a pile 10 feet square they would form a mass twice as high as the Washington Monument.

How tremendously patented inventions have contributed to the prosperity of the United States appears from the growth of industries depending entirely on inventions.

In the generation between 1880 and 1910, the value of our iron and steel manufactures leaped from $207,000,000 to $1,377,000,000, an increase of 566 per cent Between 1860 and 1910 the output of sewing machines grew from less than $4,500,000 to over $28,000,000, an increase of 522 per cent. Between 1850 and 1910 the production of agricultural implements increased from less than $21,000,000 to over $146,000,000, an increase of 596 per cent. In the generation from 1880 to 1910 the output of photographic apparatus increased from $142,000 to nearly $16,000,000, an increase of 1,117 per cent.

Coming down to more recent examples of manufactures covered by patents

In the decade between 1899 and 1909 the output of automobiles leaped from less than $5,000,000 to over $249,000,000, an increase of 4,880 per cent; the production of wire increased from less than $9,500,000 to nearly $90,000,000, an advance of 847 per cent, the output of phonographs from about $2,000,000 to nearly $12,000,000, a growth of 509 per cent; the production of cash registers and calculating machines from about $5,500,000 to nearly $24,000,000, an increase of 336 per cent; the output of patented food preparations from $30,000,000 to $125,000,000, a growth of 280 per cent; the production of fountain pens from a little over $1,[illegible] to over $4,[illegible],000, an increase of [illegible] per cent; the output of photo-engraving from [illegible] to over $11,000,000, an increase of [illegible] per cent; the [illegible]

duction of rubber goods from $52,500,000 to $128,500,000, an increase of 145 per cent; the production of typewriters from less than $7,000,000 to nearly $20,000,000, an increase of 183 per cent, the production of electrical machinery from $92,000,000 to $221,000,000, an increase of 140 per cent.

The increase in our national wealth produced by commercial inventions is recorded in staggering figures

In 1905 our manufactures of iron and steel products aggregated $2,177,000,000, our manufactures of textiles amounted to $1,387,000,000; our production in the printing and publishing trades was $597,000,000, and our manufactures of petroleum products totaled over $175,000,000. During the five years between 1905 and 1910 these manufactures increased, on an average, nearly 30 per cent.

During the two generations from 1850 to 1910 the production of cotton manufactures jumped from less than $62,000,000 to over $628,000,000, an increase of 913 per cent. In the same period the production of woolen manufactures leaped from about $48,500,000 to over $507,000,000, an increase of 946 per cent. Over the same years the production of silk manufactures increased from less than $2,000,000 to nearly $197,000,000, an increase of 9,750 per cent In these three industries alone, each of which owes its very existence to machinery made possible by patented inventions, the amount of wealth produced in 1910 aggregated the enormous sum of nearly $1,333,000,000.

How widely this enormous wealth is diffused among independent manufacturers and their employees appears from the figures of several representative industries

Between 1850 and 1910 the capital engaged in the manufacture of agricultural implements grew from $3,500,000 to $256,000,000, affording occupation in 640 individual establishments to nearly 60,000 employees, who received in the aggregate nearly $40,000,000 annually in wages During the same period the capital engaged in making sewing machines grew from $1,500,000 to $33,000,000, affording occupation to 21,000 employees, who received annually $12,500,000 in wages. In the generation between 1880 and 1910 the manufacturers engaged in the making of electrical machinery grew from 76 concerns with $1,500 000 capital to 1,009 concerns with $268,000,000 capital, affording occupation to nearly 106,000 employees, who received in the aggregate about $70,000,000 in wages.

Coming down to more recent examples

What can be more impressive than the growth of the automobile industry? During the decade from 1899 to 1909 the automobile manufactures grew from 57 establishments with $5,500,000 capital to 743 establishments with nearly $174,000,000 capital The number of employees, meanwhile, increased from 2,509 to 85,359 The wages paid to these employees increased during this period from $1,500,000 to $58,000,000

Between 1899 and 1909 the establishments engaged in wire manufactures increased from 29 to 56, their capital grew from $4,000,000 to over $60,000,000, the number of their employees increased from 1,700 to 20,000, their aggregate wages rose from less than $1,000,000 to $12,500,000

During the same period the establishments engaged in the manufacture of typewriters increased from 47 to 89, their capital grew from less than $8,500,000 to over $26,000,000, the number of their employees increased from 4,800 to over 12,000, their aggregate wages rose from $2,750,000 to nearly $9,000,000

Over the same period the establishments engaged in the manufacture of patented food products increased from 645 to 1,213, their capital grew from $21,500,000 to $64,500,000; the number of their employees increased from 9,760 to 21,000; their aggregate wages rose from $4,500,000 to nearly $13,000,000.

In the same decade the establishments engaged in the manufacture of optical goods increased from [illegible], their capital grew from [illegible], the number of their [illegible]

wages rose from $10,000,000 to [illegible]

Throughout the same period the establishments engaged in the manufacture of phonographs increased from 11 to 18; their capital grew from $3,000,000 to $34,000,000; the number of their employees increased from 1,400 to 6,000; their aggregate wages rose from $9,750,000 to $80,000,000.

Over the same years the establishments engaged in the manufacture of fountain pens increased from 43 to 65, their capital grew from $1,000,000 to over $3,000,000, the number of their employees increased from 741 to 1,820; their aggregate wages rose from $500,000 to $1,185,000.

During the same decades the establishments engaged in the printing and publishing business increased from less than 24,000 to nearly 32,000; their capital grew from $333,000,000 to over $588,000,000, the number of their employees increased from 136,000 to 389,000, their aggregate wages rose from $130,000,000 to $268,000,000

The value of American manufactures attributable directly or indirectly to patented inventions is stupendous. In 1909 it amounted to nearly $21,000,000,000—one fifth of all the wealth of the United States; six times the total money in circulation; twenty times as much as would be required to pay the national debt; and two hundred and sixteen times the value of all the gold produced in the United States. The amount of wages which these industries paid out in 1910 amounted to nearly $5,000,000,000—more than half as much as the total wealth of the United States in 1850, about two thirds as much as the total money in circulation in 1910, seventeen times the total wages paid in the United States in 1850, and seventy-one times the total amount of money coined in 1910. To invention, more than to any other cause, is due the fifteen-fold increase of wealth in the United States from $7,135,000,000 in 1850 to $107,104,000,000 in 1909. Human comprehension is inadequate to grasp such figures.

That wealth produced by patented inventions is more widely distributed among employees and independent manufacturers than wealth produced in any other fashion is strikingly shown in the boot and shoe industry. Between 1900 and 1905 the capital invested in the industry increased from about $99,000,000 to $122,500,000, an increase of over 23 per cent, and during the five years from 1905 to 1910 the capital leaped to over $197,000,000, an increase of 61 per cent. Between 1900 and 1910 the commercial ratings of the shoe manufacturers in the United States jumped from less than $61,000,000 to nearly $99,000,000, an increase of nearly 62 per cent. Between 1905 and 1910 the salaries and wages of all persons employed in shoe factories in the United States leaped from less than $78,000,000 to nearly $110,000,000, an increase of 41 per cent. Salaries alone increased 99 per cent, and wages alone increased 34 per cent. During the same period the number of salaried employees expanded from 8,811 to 14,513, an increase of 65 per cent; and the average number of wage earners increased from less than 150,000 to over 185,000, an increase of 23 per cent. From 1900 to 1905 the product of American shoe manufacturers increased from less than $259,000,000 to over $320,000,000, an increase of nearly 24 per cent. During the five years from 1905 to 1910 the output grew to nearly $443,000,000, a gain of 38 per cent. Between 1899 and 1910 the value of the exports of boots and shoes jumped from less than $2,000,000 to nearly $14,000,000, an increase of over 600 per cent. According to the last census this prosperity is shared by 50,000 independent retail shoe dealers and 1,343 separate shoe manufacturing establishments, all independent, who employ in the aggregate nearly 200,000 people and have an individual output of from 300 pairs to 25,000 pairs a day. "This industry," states the Massachusetts Commission on the Cost of Living, in its recent report, "is one of the few great lines of industrial enterprise in the United States in which the trust [illegible] has not made headway."

These figures all show that [illegible] the [illegible] of a [illegible]

inventor, although backed by a small concern, still has the magic "open sesame" that unlocks the door to the best markets of the world, and that in developing his own business and adding to his own wealth the inventor adds a hundred-fold to the wealth of the whole community

Some Old Sewing Machine Patents

IN an interesting memorandum published in the consular and trade reports of the Department of Commerce, Dr Darby of the Patent Office tells of the development of the sewing machine how the earliest attempt at sewing by machinery of which there is any authentic record was in 1755, in which year a machine was patented in England by Charles F Weisenthal, in which machine the stitch was formed by a needle having two points with an eye at mid length which passed completely through the goods in imitation of hand sewing

Following this came an English patent dated July 17th, 1790, granted to Thomas Saint, for a machine that embodied several features employed in the modern sewing machine, namely, an overhanging arm, a horizontal cloth plate, a vertically reciprocating needle, and a feeding device. The needle, notched at its lower end, pushed a loop of thread through a hole previously made by an awl The loop thus formed was held beneath the goods, and the next loop was passed through it, thus making what is known as the chain stitch"

An Englishman named Duncan in 1804 made a chain stitch machine that employed two hooked needles, and in 1830 a Frenchman named Barthelemy Thimonnier invented a machine which embodied the same principles with the exception that the loop of thread was pulled instead of pushed through the fabric

The first American patent for a sewing machine was issued to a man named Lye in 1836. A fire, which occurred that year destroyed all the Patent Office records so that the construction of this machine is not known

It is said that in the years 1832 to 1834 Walter Hunt of New York city built what was probably the first lock stitch machine This was provided with a curved needle (with an eye near the point) mounted on a vibrating arm. A loop was formed beneath the cloth by this thread-carrying needle, and a shuttle carrying an additional thread was passed through the loop thus formed, making a lock stitch Hunt however, did not apply for a patent until after the granting of the Howe patent and his application was refused.

On February 21st, 1842, patent No. 2,466 was granted to John Greenough, which was the first United States patent for a sewing machine of which there is any existing record. This machine employed two needles, pulled entirely through the cloth by pincers, and the stitch was formed with two threads, the machine being used principally on leather work

March 4th 1843, patent No. 2,982 was granted to B W Bean December 27th, 1843, patent No. 3,389 was issued to G H Corliss, and July 22nd, 1844, patent No. 3,672 was granted to J Rodgers. In all of these machines a thread-carrying needle was pulled entirely through the cloth by pincers or clamps, forming what is known as a basting or running stitch

Elias Howe patented his machine September 10th 1846, patent No. 4,750.

The patent No. 6,439, granted to Bachelder May 8th, 1849, had a spiked endless belt passed horizontally around two pulleys. This constituted the first practical continuous feed.

The Singer patent, No. 8,294, August 12th, 1851 the A. B. Wilson patent, No. 9,041, June 15th, 1852; and the Wilson patent, No. 12,116, December 19th, 1854, followed. The last named patent included a feed device comprising a horizontal bar furnished with a serrated surface, which bar was given an up-and-down motion in addition to a forward-and-back motion to feed the goods. This feed, known as the four-motion feed, is present in practically all modern sewing machines.

At the present time sewing machines are divided into two classes, one including those for household or domestic use and the other special machines, such for instance as the McKay shoe sewing machines.

The Big Aeroplane and Transatlantic Flight

THE offer of a prize of $50,000 for a flight across the Atlantic Ocean in seventy-two hours, which was made recently by the *London Daily Mail*, has already brought forth about a dozen well known constructors and pilots who are preparing machines for this flight.

Something over a year ago, we published in the SCIENTIFIC AMERICAN a very complete article on the transatlantic crossing by aeroplanes, together with a full page illustration of a proposed biplane with five 50 horse-power Gnome motors by which Aviator Mariner James V Martin proposed to make the long flight. Recently a hydro-aeroplane has been constructed in England having three 50 horse power Gnome motors arranged in somewhat the same manner as suggested by Mr Martin, and having two floats in the shape of boats beneath the machine in each of which three passengers are carried. This machine although only about half the size of the one designed by the American aviator is built along the lines suggested by him. His idea was that after the machine was once in the air, one of the motors could be disconnected and the machine would run on the other four motors, or two hundred horse-power As the fuel was used up and the machine became lighter another motor could be cut out and perhaps before the end of the voyage the machine would fly on but two motors, thereby making a great saving in fuel.

In order to cover the 1,800 miles from Newfoundland to Ireland, a speed of sixty miles an hour must be maintained for thirty hours. To maintain such a speed continuously on a machine large enough to carry sufficient fuel to make the flight without a stop, a motor of from 150 to 200 horse-power is necessary A six-cylinder water cooled motor, such as is used on the German Zeppelin dirigibles, is the most economical and reliable motor for this purpose Such a motor will consume only about one third of a pint of gasoline per horse-power hour and very much less oil than will an air-cooled, revolving-cylinder motor like the *Gnome*. A 50-hour continuous run is nothing out of the ordinary for one of these airship motors, but in order to be absolutely certain of making the crossing, it would be well to have a second such motor in reserve.

The main point to be taken into consideration in the design of a transatlantic aeroplane is the reduction as far as possible of the head resistance On this hangs the probability of crossing at the maximum speed and the minimum expenditure of fuel (that is, weight) As to the machine itself this can hardly be constructed to weigh less than fifteen pounds to the horse-power With fuel, powerful motors, men and supplies added, this weight may increase to as much as thirty or forty pounds per horse-power, which would mean a huge machine having 1,200 to 1,800 square feet of surface and weighing complete between three and four tons. At once the question will be asked, whether such a machine has ever been built and flown successfully.

The answer is, that some six months ago an aero-yacht biplane was constructed for M Deutsch de la Meurth. This machine weighed complete with its live load over 6,000 pounds, and, propelled by a 200 horse-power motor, showed a speed of 68 miles an hour Although a clumsy hull was fitted beneath the biplane, excellent speed was made with six or eight people. With the live load put into fuel, this machine would be capable of making perhaps one third of the distance across the Atlantic.

Another huge hydro-aeroplane that has recently been constructed and that was sent to Monaco for the [illegible]

is a huge following surface biplane consisting of two sets of biplanes mounted upon a single hydroplane hull, in which there are two 250 horse power, six-cylinder motors geared by chains to drive a single propeller. This huge machine has a spread of nearly eighty feet and weighs empty 11,400 pounds. It is, therefore comparable in size and weight to the Maxim machine which was built and flown in England in 1891 and which had it been mounted upon floats and tried on the water as it was the intention of Mr. Maxim's chief helper Henry A. House to do would have undoubtedly flown without mishap instead of being quickly smashed as it was when it ripped up the holding down guard rail of the track upon which it was tried. This machine by the way had 350 horse-power consisting of a steam engine and double propellers.

While neither of these two large hydroaeroplanes just mentioned has been designed with the idea of cutting down the head resistance there is no doubt that with all the experience obtained with dirigible balloons and aeroplanes having streamline bodies it will be possible to design a machine having very much less head resistance than the usual weight carrying biplane apparatus of the present day.

Obtaining Power from a Testing Plant

(Concluded from page 408.)

during the test for power purposes.

The tractors are belt connected to shunt wound generators running in parallel. This makes a very flexible outfit as each engine load can be regulated by the rheostat of its generator and the load can be increased from small to full load as the engine warms up and works into the best condition. The fuel and water supply pipes run to each engine making it an easy matter to keep the engine tanks filled. Each fuel pipe is provided with an individual meter. Suitable stacks are arranged for the exhaust gases and easily adjusted blocks under the drivers hold the tractor in the belt.

The changing of a tested tractor is a matter of five minutes. Fuel and water pipes are removed from tanks, blocks knocked loose and the stack raised. The tractor is then run ahead and the belt removed. The operations are reversed when running a newly constructed machine into belt.

The dynamos are shunt wound direct current 250-volt machines. This type is used because it is automatic to an extent in regulation. If there is any trouble with an engine the shunt machine can motor thus often saving the trouble of starting an engine because of dirty plugs or some minor trouble. Also in case it is desired to so do the rheostat can be adjusted to carry a very small load. Further engines of 10, 40, 60 and 80 horse-power are often being tested at one time. This condition would be quite difficult to handle with any other type of dynamo.

All wires are run under the floor in conduits from each machine to the back of switchboard.

A balance set is used as the plant furnishes current for both light and power. The balance set is started by means of two switches and a rheostat, the field being permanently connected to the busbars. The balance set consists of two 30-kilowatt generators. The shafts are flexibly connected, and there has been no mechanical trouble whatever. The overload capacity is large as a number of large motors have been constructed that run with 220-volt field and 110 to 220-volt armature current.

The power generated is used for running a machine shop, two foundries and various machines and lights about the plant. Two 20 and two 10-ton cranes, two 50 horse-power air compressors and large heating fan motors are some of the heavier motor loads. These machines and lights, of course, cause a great variation in the load, frequently varying it 100 per cent within a short time.

NEW BOOKS, ETC.

Les Orages. Application des ondes hertziennes à leur observation. Julien Loisel, docteur-ès-sciences, météorologiste à l'observatoire de Juvisy Préface par Camille Flammarion Paris G Thomas, 1912. 8vo, pp. vii, 120.

This is destined to be regarded as a standard work on thunderstorms and as no such work exists in English it is commended to the attention of American students and readers. The book is not difficult reading as it involves but little mathematics, but on the other hand it is a serious treatise not written to divert the multitude.

Thunderstorms are just now occupying the European mind to an unprecedented extent, mainly for two reasons (1) Great efforts are being made in the Old World to avert or mitigate the destructive effects of hail whether by "hail-shooting hail-rods hail insurance, or protective measures contingent on timely warnings, and hail is the accompaniment of thunderstorms. In France alone hailstorms cost the country anywhere from \$8 000,000 to \$27 000,000 a year in ruined crops. (2) Thunderstorms constitute a grave danger to the aeronaut.

Dr Loisel's book is a handy digest of the recent literature of his subject, fortified throughout with references to original sources of information including many memoirs published in the scientific journals during 1911 and 1912 Thus we find the very latest attempts to explain the electrical field of the atmosphere which take into account big and little ions ultra-violet light radioactive discharges from the sun and the earth and the other novel agencies belonging to twentieth century electrical science. In the chapter on the electrification of clouds, the author presents not only the Wilson-Gerdien and Simpson hypotheses but some objections to the latter put forth by J Rey in a university thesis published in 1912 which has hardly yet found its way into the scientific libraries The description of lightning phenomena might well have given more emphasis to the epoch-making researches of Walter and might have been a little more positive as to the cause of black lightning, but is on the whole adequate Here, as elsewhere in the book we find a well-chosen collection of excellent photographs lacking only the moving-camera pictures which Dr Walter and others have made so familiar to the readers of the scientific journals, and which should certainly be included in any modern work on thunderstorms.

The relation of thunderstorms to the general barometric conditions is brought out in a chapter of text and charts. The author avoids giving too much prominence to the line-squall type of thunderstorm with which M Durand-Gréville's name is inseparably connected and quotes the opinion of Angot that this type of storm is not so general as has been assumed in recent meteorological literature A chapter is devoted to the question of predicting the movements of thunder storms from the ordinary weather map and from the reports of a dense network of observing stations especially installed for this purpose and points out how successfully such predictions have been made in Germany for the benefit of aeronauts This subject leads up to a long final chapter on ceraunographs, or thunderstorm recorders.

The Romance of Submarine Engineering Containing Interesting Descriptions in Non-technical Language of the Construction of Submarine Boats, the Salving of Great Ships, the Recovery of Sunken Treasures, the Building of Breakwaters, Docks, and Many Other Feats of Engineering Beneath the Surface of the Water By T W Corbin With 54 illustrations and diagrams London Seeley, Service & Co, Ltd 1913

The only serious omission that we can call attention to in this book is the failure to discuss the use of compressed air in the raising of sunken ships a method that was used with conspicuous success in raising the "Barbarian" and other vessels The book on the whole may be commended for presenting a very readable account of diving apparatus, submarine boats, caisson work and submarine apparatus in general.

Saw Filing and Management of Saws. By Robert Grimshaw. New York Norman W Henley Publishing Company, 1912 16mo Price, \$1

This is a book which is designed as a practical aid to those who use saws for any purpose. While, as its title implies it treats principally of saw-filing it also goes into the questions of gumming spring-setting and swaging

Wireless Telegraphy and Telephony Simply Explained. A Practical Treatise by Alfred P Morgan. New York The Norman W. Henley Publishing Company, 1913. Price, \$1.

This book embraces a complete and detailed explanation of the theory and practice of modern radio apparatus and its present-day applications, and contains a chapter on the possibilities of its future development For those who wish an accurate, simply-worded book, suitable for a novice, Mr Morgan's volume can be heartily recommended

The Cinematograph and Natural Science. By Leonard Donaldson. London Danes, Ltd, 1912. 12mo. Price, 2s. 6d. net.

In this excellent handbook Mr. Donaldson has most interestingly revealed the part that the motion picture has played in science during the last few years. He has [illegible]

of the public, whose knowledge of motion photography is more or less limited to the amusement phase, an exposition of the scientific achievements of the cinematograph, coupled with various suggestions as to its possibilities of further utility in scientific research He therefore discusses the motion picture as an educator and shows how successfully motion pictures have been used in schools. That the motion picture is an aid to operative surgery is revealed in a chapter which includes, among other things, the views of Dr Doyen, which have been rather widely quoted in medical periodicals So too the author takes up the subject of the X-ray and the cinematograph. He shows the value of the moving picture in biological experiments and in photographing the pulsations of the heart as well as in recording the flight of insects A whole chapter is devoted to micro-cinematography and bacteriology Interesting is his account of the manner in which natural phenomena are recorded on the moving film How the motion picture has been used in astronomy exploration, physiological botany wireless telephony aerial navigation etc is also taken up

LE TEMPS QU'IL FAIT, LE TEMPS QU'IL FERA. Notions de météorologie à l'usage des aéronautes et des aviateurs. A Berget. Paris Librairie Ch Delagrave, 1912 8vo., 261 pp , illustrated

For some years to come every new publication on the new science of aeronautical meteorology will inevitably be compared with the pioneer work in this field Linke's 'Aeronautische Meteorologie (Frankfurt, 1911) Few books will not suffer by the comparison, and Dr Berget's is not one of the few Only the fact that the literature of this important subject is still meager and that many aeronauts who are able to read French are to their infinite disadvantage unable to read German makes it desirable to call attention in these columns to the first attempt on the part of a Frenchman to cover the subject in some detail.

The limits of aeronautical meteorology are not sharply defined but Linke set a commendable example in confining his work very closely to matters of practical importance to the aeronaut, and not duplicating more than was necessary of the information found in ordinary works on meteorology If Berget had followed the same plan his book would have been about one tenth its actual size The aeronautical information is diluted to the last degree though occasionally it is valuable and even includes a few facts that Linke overlooked Berget's meteorology is not always sound. The most remarkable blunder in his book is found on page 54 where it is stated that the isothermal layer is only three or four kilometers thick and that the fall of temperature with increase of altitude (the vertical temperature gradient) is resumed above it This statement bears eloquent testimony to the author's unfamiliarity with almost everything that has been written about upper-air meteorology (a whole library in itself) during the past eight years. The author also has faith in the efficacy of reforestation and inland seas to increase the rainfall, and in cannonading to avert hailstorms doctrines that only the dilettante proclaims without, at least, a pace to the authorities. Why is 'hail-shooting mentioned at all in a work on aeronautical meteorology? Because, of course aeronauts must be warned to keep out of range when this kind of bombardment is in progress! True the hail-cannon discharges no projectile but think of the eddies ! The present reviewer diffidently suggests a comparison between the violence of these artificially-produced eddies at an altitude of 400 to 500 meters and that of the natural atmospheric billows and whirlpools which are negotiated with ease by every airman

For readers already well grounded in meteorology there are some useful and suggestive things in Berget's book On pages 19 to 26 there is a clear exposition of the relations between actual and relative velocity in the air and of the limits imposed by the winds upon the actual dirigibility of "dirigibles. Elsewhere there is enough grain scattered through the chaff to render the book well worth reading However, the amount of pertinent information omitted considerably exceeds what is included Not to multiply examples, although whole chapters are devoted to various methods of weather forecasting not a word is said about the special storm warning services for aeronauts which have grown up in Germany in the last few years, and are beginning to be imitated in other countries.

As the book is French it contains no index of course, But strange to say, neither does Linke's, which is German!

AN EXTENSION OF THE DEWEY DECIMAL SYSTEM OF CLASSIFICATION APPLIED TO THE ENGINEERING INDUSTRIES. By L. P Breckenridge and G A. Goodenough. Originally issued as Bulletin No. 9 of the Engineering Experiment Station in 1906.

The filing and classification of engineering data has become a matter of much importance, and this bulletin was prepared for use as a guide in carrying out such work. The original edition of Bulletin No. 9 was subject to the usual gratuitous distribution, and the subsequent demands were such that a second edition was printed and ultimately distributed. Altogether 26,000 copies were sent out. The demand having continued, it was finally decided again to revise and to print a limited edition. This has now been accomplished and the revised bulletin, much extended as compared with the original edition, is ready for distribution. It presents subdivisions of subjects in such detail as to constitute a complete classification for most engineering industries, even though they are highly specialized. The revision has been ... with the 1911 edition of "Decimal Classification" by Melvil Dewey.

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding [illegible] matters as patents, subscriptions, books, etc. This will greatly facilitate answe[illegible] questions, as in many cases they have to be referred to experts. The full name and [illegible] should be given on every sheet. No attention will be paid to unsigned queries. [illegible] to correspondents are printed from time to time and will be mailed on request.

Inventors and others are notified that although their questions are proper enough, they cannot be answered unless the name and address of the writer accompany the question. There will be no deviation from this rule.

(12788) G M asks Can you tell me if you have any SUPPLEMENTS containing information of the construction of electrically operated, self-winding clocks, using dry batteries as the source of power? A You will find in our SUPPLEMENT 153 180 196 and 962 price ten cents each, the descriptions of electrical clocks. The clock, patented under the name self-winding clock is a regular clock movement with a spring which is wound by an electric motor every hour or half hour 2. Can you tell me if the fused silicon which can be obtained from wholesale drug houses is suitable for use in making the silicon detector used in wireless telegraphy and if not, will you kindly tell me where I can obtain same, and have you any SUPPLEMENTS on construction of said detector? A The form of silicon used for a detector is a crystal which is set in a holder and ground off on an oilstone till one side is flat and smooth The making of the whole apparatus is described in Morgan's "Wireless Telegraph Apparatus for Amateurs" which we send for $1.50 and shall be glad to receive your order for a copy The book gives sizes and all instructions for making the entire outfit, with engravings of all the parts.

(12789) L L L asks We are nickeling stove trimmings What is the best analysis and best shape of anode to use? We are now using anodes ½ inch thick 6 inches wide and 19 inches deep A Nickel anodes should be of the purest nickel The cast anodes are the softest, and will pass into the bath with greater ease than the rolled or those made by electricity They have the disadvantage of becoming brittle before they are all consumed. The usual shape is a rectangle of about the proportions which you already have. The size depends upon the amount of surface of articles to be plated which you have in the bath at one time. The whole subject is fully discussed in Langbein's "Electro-Deposition of Metals," which we send for $5 and for which we shall be pleased to receive your order

(12790) D C G says I have just observed something that may be a common phenomenon, but as it has never come under my observation before and I have never seen a note of it am submitting it for what it may be worth In front of our factory is a long railway siding on which much switching is done. By the side of the track and distant perhaps eight or ten feet is a line of poles carrying wires of one of the Niagara Falls power companies. These wires are about two feet apart, and carry 12,000 volts 3-phase 25-cycle current. Amperage of course I do not know A few days ago a switching engine happened to pass along by the side of them, and as the mingled gas and steam rose through the wires there appeared a peculiar flickering like waves from wire to wire It coincided with what I should judge to be the cycles of the current It was not light, but gave the impression of waves. It was not present when there was clear steam but only when the smoke and steam mingled rose through the wires The day was bright, and the sun was shining clearly on the wires and smoke when it was apparent. This morning was a dark morning with some mist in the air, and the same thing occurred only more clearly as the volume of smoke and steam was greater I called our draftsman to note the effect, which we both saw clearly A The smoke, which consists of solid carbon particles and hot gases, would easily be charged by the wires and vibrate in sympathy with the cycles of the current. This may be what you saw as the smoke of the locomotive rose through the wires of the transmission line.

(12791) A G W. asks: We would thank you to give us the latest description and definition of radium also what uses it is being put to and its intrinsic value. A. Radium is an elementary substance in the same sense as iron is an elementary substance. Many scientists believe that it is on the way to become some other substance, with different properties. It is not being put to any practical use unless by the physicians in the treatment of cancers, although here we cannot say that success is demonstrated as yet. We have published many articles upon radium, covering everything known concerning it. In addition to those in the catalogue which we send you, you will find a very valuable series by Prof J J Thomson in SUPPLEMENT 1849, 1850, 1851 On the origin of radium, in SUPPLEMENT 1900, Radium in medicine SUPPLEMENT 1866, and many others. We send these papers for ten cents each.

(12792) H C G. B. writes Referring to the letter of Mr Wood (SCIENTIFIC AMERICAN, Vol 108 No. 13) as to the astronomical bull of placing Jupiter in Cassiopeia, I would say that it is not two famous men who made it, but only one, viz. Coleridge. Schiller says: "Der meiste Schimmer, der einzige, ist aus der Kassiopeia, und dahin steht der Jupiter." "Dahin" does not mean "therein," but "yonder." Cassiopeia is in one direction and Jupiter in another. The last editor who showed up Coleridge's blunder is Buchheim. (See his edition of "Wallenstein," Vol. II, p. [illegible].) A. You are quite right in your statement that the 'astronomical bull' is that of Coleridge, and not of Schiller in placing Jupiter in Cassiopeia. The simplest translation of dahin is "thither in that direction," which would direct the attention in some other direction than toward Cassiopeia. It is then a wrong translation by Coleridge. Schiller was well versed in astronomical matters, and it would seem impossible for him to have made so false a statement Jupiter at its nearest approach to Cassiopeia is about 55 degrees from Schedir, the brightest star of Cassiopeia. Among English poets Tennyson probably ranks highest for his strict adherence to the facts in his astronomical allusions.

(12793) P B. S Can you tell me if there is a big field for chemists and electrical engineers, and if the remuneration for their (the average chemist and electrical engineer) services is sufficiently large to live well? If possible, could you tell me what the various positions these two fields cover, and what qualities a young man must have to be a successful chemist or electric engineer I am a high-school graduate have been in business over three years, but want to study a profession. The above-mentioned lines appeal to me, but I do not know much about them. A. Chemists and electrical engineers generally find work. We cannot say that it is always a [illegible] field nor that the salaries are always large. [illegible] 'there is always room at the top,' and if you make yourself a first-class man there will [illegible] difficulty in getting something to do, by [illegible] you will be helpful in the doing of the world's work. The qualities which will bring success in these lines are the same as will bring success in any other line They are a thorough mastery of the technique of your subject willingness [illegible] hold of the nearest thing and to do it f[illegible] and well Chauncey Depew wisely said [illegible] young man who would rise in the w[illegible] never question the kind of work which is [illegible] him the hours required of him or the [illegible] agreeable or disagreeable to which he is [illegible]." Get ready for your work in the schools, [illegible] Mr Depew's advice, and success will [illegible]. You will find seven engineering fields discussed in the SCIENTIFIC AMERICAN, Vol 108, Nos. [illegible] 18, 22 Vol. 107 Nos 1 5, 10 price [illegible] each. Among these fields are the two w[illegible] mention

(12794) U F L. asks Can rubies be reconstructed? A We presume that a ruby can be melted over and thus reconstructed, but as the natural ruby brings a much higher price than the artificial ruby it is not probable that anyone would thus reconstruct a ruby The artificial ruby is exactly like the natural ruby in its chemical constituents color hardness, etc.

(12795) E K D asks Is it possible, within attainable altitude for any one ascending in a balloon to see the earth as a revolving globe? A It is not possible, by going up in a balloon, to see the earth moving under you by its motion of rotation The balloon will be borne along by the motion of the air with the earth in its rotation, so that the earth will only seem to move under the balloon as the wind blows the balloon along over the surface of the earth

(12796) D S asks 1 Is the ri[illegible] the sun the same as what is called t[illegible] And is this ring always the same distan[illegible] sun when it appears? A A sun dog' [illegible] of a halo or ring around the sun, usua[illegible] of 22 degrees, although halos of 45[illegible] 90 degrees also occur There are m[illegible] the halo the principal of which appe[illegible] illustrated article in the SUPPLEMENT, No. [illegible] price ten cents. The halo is [illegible] clouds which are composed of ice [illegible] the air where the temperature is below [illegible] ing point. 2. In what manner is the [illegible] the sunlight performed to obtain [illegible] How is ozone formed in the [illegible] there has been no discharge of [illegible] have seen the statement in elementary [illegible] that ozone is usually present in the [illegible] higher textbooks do not justify [illegible] We quote two. Alex. Smith's "[illegible] Chemistry: "It is very [illegible] there is any ozone in the air, [illegible] arily in the immediate [illegible] or artificial discharge of electricity [illegible] sen's "College Chemistry" "No [illegible] dence of the occurrence of ozone in [illegible] ever been furnished." With two [illegible] support us we shall not attempt to [illegible] ozone in air when there has been no [illegible] electricity.

(12797) T. O. B. asks: Is [illegible] reptile as the hoop-snake? If so, has [illegible] to propel itself by grasping its tail [illegible] and rolling like a hoop? Has it a [illegible] up its tail which is used as a means of [illegible] offense? If such a reptile does not [illegible] existing the legend? A. The hoop-snake [illegible] less species of snake abundant in the United States. It is a fable, says [illegible] Dictionary, that it [illegible] and roll itself along like a hoop [illegible] how the belief originated [illegible] do we know any snake in this [illegible] [illegible] tradition.

SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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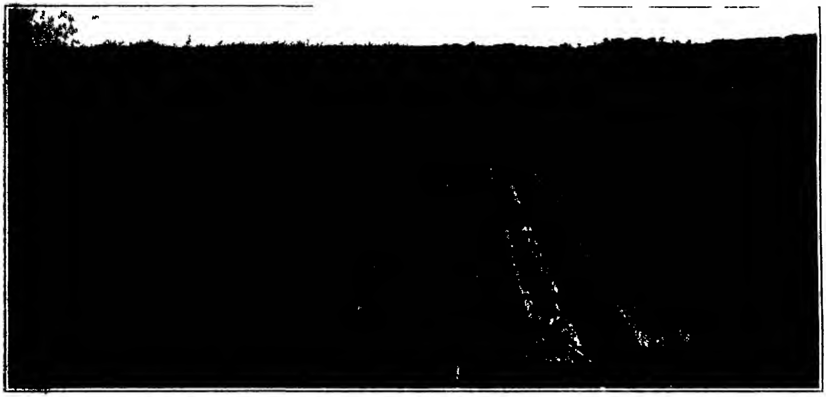
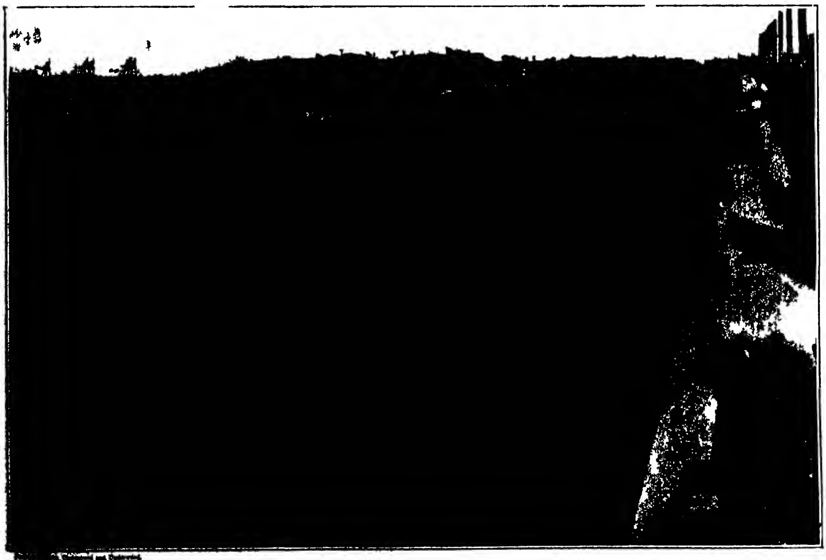


Gatun Lake and the south approach wall of Gatun locks. This artificial inland sea will cover nearly 170 square miles of the Chagres Valley



The upper guard gate at Gatun, the first to be completed. In front is the water of Gatun Lake

SOME RECENT VIEWS FROM THE PANAMA CANAL.—[See page 432]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are *sharp*, the articles *short* and the facts *authentic* the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

Science and Journalism

IN an excellent address delivered before the School of Journalism of Columbia University, and abstracted in a recent number of the *Independent* Dr Edwin E Slosson lays an unerring finger upon the inadequate presentation of scientific discoveries in the daily press Although the staff of every large newspaper includes such specialists as a dramatic editor who confines his attention to the plays of the day, a sporting editor who limits himself to a special field, a financial editor who reviews the course of the stock market and a literary critic who gives his opinions on new books, no publisher has as yet thought it worth while to entrust the chronicling of scientific achievements to a competent journalist Yet the real news of the day is often scientific news. Because the newspaper records industrial and scientific happenings in a slipshod way, we find it wofully behind the times Thus, radium was not discovered by the newspapers until three or four years after the scientific papers of the world had marveled at its strange phenomena Only now is the newspaper reader becoming acquainted with Mendel's laws, although the biologist has applied them since 1900 The principles of efficiency engineering and the astonishing success of the Taylor system had been set forth in engineering periodicals fully two years before they were enunciated by the daily press. At this rate the intensely fascinating papers which Sir J J Thomson recently delivered before the Royal Institution will find their way into the Sunday supplements some three years hence although no more dramatic scientific announcement has been made in many a day

When the newspaper does take up a scientific achievement of epoch making importance, it usually distorts it beyond recognition as Dr Slosson points out This is to be attributed partly to the ignorance of the staff writer to whom the presentation of the achievement in question is entrusted, and partly to the "human interest" standards by which editors of newspapers judge all writing To be sure, nothing is so interesting to man as man But is that any reason why his scientific work should be minimized and even misrepresented? Is it more important to record the fact that the man who discovered synthetic rubber is probably bald and wears spectacles than to tell in plain simple terms how genuine rubber can be made from raw materials with which everyone is familiar?

But whatever may be the faults of the average newspaper the scientist is in part responsible for them. "The public does not know what is being accomplished in the laboratories," Dr Slosson assures us he once said to a distinguished scientist. Why should they? was the retort. 'It is none of their business."

This attitude Dr Slosson seems to approve. But is it correct? Admitting that it is the business of the newspaper to employ a competent scientifically trained man to write on important technical discoveries, is it not also the duty of the university and the laboratory to circulate sound information on science? University settlement work finds its counterpart in correct simply worded newspaper reports of work performed by distinguished scientists. Institutions such as the Carnegie Institution of Washington could vastly increase their influence by popularizing the results of their investigations.

It is an unwritten law—perhaps a written law—that a reporter sent out to obtain an interview must not come back empty handed The refusal to grant interviews often leads to a species of misrepresentation that does the scientist and the institution with which he is connected incalculable harm. Ten minutes or even half an hour of elementary exposition would often spare the university professor the annoyance of reading outrageous statements attributed to him. During the halcyon days of Halley's comet in 1910, when that historic body was being sadly maltreated in the newspapers, about eighteen reporters camped on the ground of one of our largest observatories. Their clamor for information was met with the assurance that Halley's comet was none of their business. Newspaper photographers requested members of the staff—some of them astronomers of international reputation—to pose at the eye-piece end of a huge telescope, and received a flat refusal, in accordance with the well-established scientific custom in such cases. What happened? An ingenious photographer asked the entire university staff to pose on the front steps of the observatory, which they did. That seemed harmlessly unastronomical, but it was enough. One of the most distinguished members of the staff was depicted the next day in a newspaper with a circulation of 800,000, seated at the eye-piece end of his instrument, gazing penetratingly at Halley's comet! His picture had been cut out of the staff photograph, pasted on a picture of the telescope, and the whole photo-engraved. To be sure, it was a very bad piece of work from the astronomical standpoint—totally incorrect and ludicrous. But it answered the requirements of the daily newspaper How much better it would have been to have posed in the very first instance.

But what guarantee has the scientific man that even though he has taken the trouble to explain himself as simply and as clearly as possible, his views will be correctly presented? That we must admit is a serious but not an insuperable difficulty The heads of great corporations employ their publicity departments in order to make announcements in the press. Our leading universities also have their publicity departments, which are now engaged chiefly in trying to attract more students, but which might be similarly employed. A university professor whose views on a given topic are asked should be able to refer his inquirer to the publicity department of his university There the reporter ought to receive a typewritten statement, previously approved by the professor in question, which is to be published without any change If this strict prohibition is ignored, that particular newspaper need expect no further courtesies Our own experience with newspaper men has convinced us that they respect written statements.

The sooner scientific men discard the high priest attitude toward the reporter the sooner that they supply him with simply and carefully worded statements which he is entitled to receive, the sooner will we be rid of a pernicious form of journalistic misrepresentation

Social Problems and Eugenics

SCIENTISTS do not perform experiments in eugenics. They do not have to. The human race does all of that for the needs of science, and and to observe, a great deal more. Such is the sentiment expressed by Dr Charles B Davenport, director of the Carnegie Institution's Station for Experimental Evolution at Cold Spring Harbor He preaches no doctrine of scientific mating as opposed to the marriage of personal choice, instead he and his associates cull data for correlation and deduction, purposing the ultimate publication of results which will assuredly further the science of eugenics and in turn benefit humanity This Eugenics Record Office aims to be the country's clearing house for an investigation of race, of heredity of blood lines, and from this station is issued to all desiring it personal advice as to the suitability of marriages and the probabilities of inheritance. The applicant will receive a series of blank records to be filled out Thus far the data collected by this office have been mainly of abnormal types—feeble mindedness, the inheritance of epilepsy, the inbreeding of degenerate strains, but this has been because such information is easier to get. The collection of "normal data" has been difficult, because a number of people have imagined eugenics to be concerned only with imbeciles and degenerates. Dr Davenport aims now to collect from whosoever may send names, information about normal people, the talented, the genius, even the respectable, the right-minded and the right-moraled, and it is his hope that the American citizen's idea of social duty will include the recording and depositing with the Record Office of full information about his "family tree."

This Record Office is but two years old, yet thus far such facts as the following have been established: If two epileptics marry, their children will all be epileptics; the same is true of two imbeciles. If an epileptic or one insane married a normal individual, one half or one fourth of the progeny will usually inherit the parents abnormality; the other [illegible] ably be normal. A recessive trait (one [illegible] undeveloped germ form and never becoming [illegible] a given individual) may remain recessive [illegible] tions, but will very likely become active when [illegible] a like trait—recessive or not. The marriage [illegible] is not bad in itself if both families are of sou[illegible]; but such marriage will naturally bring out any [illegible] traits, and intensify weaknesses, recessive or [illegible]. The redhaired are markedly antipathetic a[illegible] marry those having red hair A good [illegible] strengthens good traits, but will not guar[illegible] the conquest of a bad inheritance. Love, in a ma[illegible] sensible human being (is ever a human being, [illegible] mature, sensible in these premises?) may be [illegible] a eugenic choice, the fact of two wholesome p[illegible] wishing to spend their lives together may be found[illegible] on instinctive traits that will make for a good [illegible]heritance, but love offers practically no more than [illegible] even chance (Nevertheless the eugenist, wise man [illegible] be is, would not do away with love, but would [illegible]bine with it, if possible, common sense and [illegible] thought.) Marriage with an individual of bad [illegible] will tend to drag down the inheritance of good [illegible]; imbecility is often introduced into "bloodlines" [illegible] have hitherto been good. One's inheritance can[illegible] judged by a consideration of the parents, for [illegible] parents may have abnormal, even criminal childr[illegible] inheritance must be traced back for generation[illegible] the records of cousins, uncles, aunts, brothers an[illegible]ters must be examined, one does not inherit fro[illegible] parents, but from the family germ plasm.

The work of the Eugenics Record Office is, in [illegible] to learn how every characteristic behaves in he[illegible] as to eugenic experiments The world is full o[illegible] latter, there are as many experiments in eugenic[illegible] there are child bearing marriages, as many "e[illegible]mental results" as there are children born. Th[illegible]nary parent may take chances as to his childr[illegible] oftentimes does) that no breeder would ta[illegible] animals. It was asked "if they were going [illegible] a farm up there in the woods and make experim[illegible] with all sorts of freaks,' no, it was answered, [illegible]ments, melancholy to relate, are all too man[illegible] constantly being made. And Dr Davenport [illegible] associates will try to show the people who ha[illegible] them what can be done with them, and how [illegible]vent some of them in the future

So the eugenist would have love and the "eugenic principles" go hand in hand in the marriage of the future, for happier homes and healthier children and the minimum of insanity, the hereditary degenerations, pauperism and crime And the object of the Eugenics Record Office succinctly is to 'serve eugenic interests in the capacity of a repository and clearing house, to build up an analytical index of the traits of American families, to train field workers to gather data of eugenic import, to maintain a field force actually employed gathering such data, to co-operate with [illegible] institutions and with persons concerned with [illegible] study, to investigate the manner of the in[illegible] of specific human traits, to promote and to a[illegible] the organization of new centers for eugenic r[illegible] and education, to advise concerning the eugenic [illegible] of proposed marriages, and to disseminate [illegible]

Should Patent Office Fees Be In[illegible]

IN its admirable report on the Patent [illegible]dent Taft's Commission on Economy a[illegible] makes the recommendation that the [illegible]ernment fees be increased. There seems to [illegible]ing that the Patent Office examiners per[illegible] arduous work for very little money, and that [illegible] number of very narrow patents are granted w[illegible] inevitably be declared invalid if they are [illegible] a validity test in an infringement suit.

We have not yet seen a satisfactory rea[illegible]creasing Patent Office fees. A sum of a[illegible] million dollars has been turned into the [illegible] the United States by the Patent Office. [illegible]stitution of the Government has made a [illegible] after year, so consistently, and piled up [illegible] so formidable a sum. An increase of fe[illegible] not justified because the Patent Office is doi[illegible] too cheaply

It is argued that patents are so easily ob[illegible] devices which do not involve real inventi[illegible]ented. Hence a certain class of patentees w[illegible]ute but little to an art which they seek to [illegible] be discouraged. But this is a two-edged [illegible] cuts both ways. If the man of small invent[illegible] is discouraged by placing financial difficulties [illegible] way, so is the genius. Moreover, it is the [illegible] object of every sound and liberally framed [illegible] to encourage and not to thwart the inventor.

Regard this recommendation of the Commi[illegible] whatever angle we will, it is [illegible] to [illegible] measure which seeks to burden inventors w[illegible] high costs.

Electricity

A 75,000 Gauss Electro-magnet.—In view of the scientific results which are obtained with the extremely powerful electro-magnet (50,000 gauss) installed at the Zurich Polytechnicum upon the designs of Prof Weiss it is now proposed to construct a still larger one at Paris by Messrs. Weiss and Cotton which will reach as high as 75,000 gauss and is to use electric current to the extent of 200 horse-power The estimated cost of the magnet is no less than $40 000 It will be placed at the disposal of all scientists who are engaged in researches which require a specially strong magnetic field

Metal Filament Street Lighting.—A test was recently made in Switzerland to determine the relative efficiency of arc lamps and metallic filament lamps for street lighting purposes Two streets of equal length were lighted, one with the arc lamps and the other with the metal filament lamps The arc lamps were of 10-ampere capacity and the incandescent lamps were of 500 candle-power The choice between the two forms of lighting was left to twenty-nine trolley-car motormen. Twenty-five of these were in favor of the metal filament lamp, chiefly because it did not irritate their eyes as much as the arc lamp

Emergency Lighting Plant for Ships—To swell the horrors of a sea disaster at night the lights are apt to be put out by the flooding of the electric generating plant But is it necessary to depend upon a plant located where it is liable to be flooded? Experiments are being made now on a large British vessel that is under construction with a gasoline electric plant that may be placed on the bridge deck This set will not only supply the light but the wireless telegraph apparatus as well so that the occupants of the vessel may be supplied with light and the means for calling for assistance until the very moment of complete submergence of the vessel This generating set will be used only in emergencies

Electric Control of Furnace Stoking—A number of the recently built battleships of the French fleet are fitted with a very effective apparatus for securing a regular stoking of the furnaces on the Niclausse system In the engine room is an electrical device at the engineer's hand which sends automatic signals to the furnace quarters a certain number of times an hour in order to control the stoking This is indicated by a luminous board in the furnace quarters having a panel for each furnace and when the automatic signal comes on an electric bell rings and the panel lights up, indicating for instance five shovelfuls in furnace No 1 and so on in turn for the other furnaces The amount of the coal feed and also the frequency of firing can be varied at times according to need by properly setting the apparatus

Oil-engine Generating Plant—One of the most successful electric tramway systems in the north of Italy has lately been installed at Parma This called for the erecting of a central station of some size in order to furnish the current needed for all the tramway lines running through the city and it is worthy of note that gas or oil engines are used for this plant One of the engines is of the new Diesel type and runs with heavy oil as fuel This oil is vaporized by a compressed-air spray and thus furnishes a gas which runs the engine on the explosion principle The new 500 horse-power Diesel engine installed in the Parma station ranks among the large sizes yet to be built and is of the upright type with four cylinders Coupled to it is the dynamo which furnishes the current for tramway use Other dynamos in the station are run by gas engines which work upon producer gas

Milan-Varese Electric Railroad—According to the most recent information about the reorganizing of the Milan-Varese electric railroad in order to provide for the needed increase of traffic the State railroad department to whom the railroad belongs decided to purchase a supply of current from a Milan electric plant and now adopts the 3-phase system at 40,000 volts upon a line running from the electric station to the railroad Along the line there are erected seven substations which take the place of the four old ones and all the substations were built new so as not to stop the traffic while the work was going on. Owing to rapid work it was possible to open the new stations last summer They have an electric outfit which receives the 3-phase, 40,000-volt current and changes it to direct current at 650 volts for use on the third rail of the road. The overhead wiring connecting up the various substations and the central station is about 60 miles long The former Tornavento electric plant of small size is no longer used for the supply Owing to the fact that the electric road passes through a very active industrial region, the traffic increased so much after the opening of the line in 1901 that a thorough change was needed. Heavier trains were also required, and this made it necessary to use a new type of electric locomotive which has recently been put into service and takes a 200-ton passenger train at 56 miles an hour, or a 450-ton freight train at slower speed Owing to the advantage over the old locomotives for 150-ton trains this allows of [illegible] down to a reasonable number of trains per day [illegible] handling a heavy traffic.

Science

The New Capital of Australia, which is to be built in New South Wales, has been named Canberra (accent on the first syllable) The ceremony of naming the projected city and laying the foundation-stones of the "commencement" column was carried out March 12th by the governor-general and a numerous company of officials and military The commencement column, which stands before the site of the capitol building will if possible, be composed of stones from all parts of the British Empire

The Red Radish in Science—An alcoholic solution of the skin of a red radish serves as an excellent indicator or test for acids and bases In the presence of acids the colorless solution turns pink while with bases—alkaline solutions—it turns yellow It is well known that many plant extracts such as litmus and animal products like the cochineal bug possess this property of developing marked colors with acids and bases but no other indicator is so simply made

Gelatin Protection—Gelatin belongs to the class of protective colloids possessing the ability to surround minute particles of suspensions with a film that prevents their aggregation into precipitates Since the formation of crystals is a growth from very small nuclei this process also may be hindered by a small amount of gelatin Commercially this principle is applied in the making of marshmallows The presence of a little gelatin does no harm in fact it is a food and it effectually prevents the crystallization of sugar within the marshmallow Commercial ice cream contains some gelatin for the same purpose to prevent the graininess of sugar crystallization But further than this the gelatin surrounds the particles of casein in the milk with a protective film which hinders curdling and greatly aids digestion

Aniline Dyes and Microbes—That aniline colors have a marked action upon various kinds of microbes appears to be established by the recent work of S Kriegler He studies the effect of a certain number of aniline colors upon microbes such as typhus coli and others and finds that aniline compounds in general act to destroy microbes this being even in greater degree than phenic acid Of the different bacteria he examined he finds that the typhus bacillus is the most readily affected On the other hand he remarks that not only can there exist differences in microbe-destroying power between the different aniline colors for the same microbe which are easily explained by diversity in chemical nature but he also notes that the same color compound does not possess an equally strong power upon different kinds of microbes In fact a given aniline color substance may act as an antiseptic in destroying one species of germs without necessarily being active as regards another species

Rock Paintings in Tunis—Rock paintings of an interesting kind in the south region of Tunis are described by M Henri Roux and published in the *Revue Tunisienne* One of these was noticed on a rock wall in the Djebel Bliji and it represents very likely a combat of men in conventional drawing and animals which it is difficult to identify The age of this painting raises quite a controversy among scientists and some think that it is contemporary with the Berber civilization that is intermediate between the stone age and the age of metals According to this idea it belongs in the last part of the neolithic period But M Roux wishes to place it at a more ancient epoch and class it in the middle or first part of the neolithic period it being due to a civilization which is more ancient than the Berbers and M Gobert also thinks that it is the work of negroid people to whom are due the flints of the neolithic age found in North Africa

Effect of Manganese and Zinc on Spores—The combined action of manganese and zinc upon the spores known as *aspergillus niger* forms the object of researches made by Bertrand and Javillier at the Pasteur Institute Some time ago they found that each of these metals taken separately had a very striking effect upon the growth of these spores The combined action is still stronger as their recent researches show, and examining the results they find that the weight produced is greater when the two metals are used together than when only one of them is employed It is seen that the productive effects of the two metals are added in these cases Observing in what way the manganese is absorbed by the spores in the presence of zinc, they find that the manganese accumulates in larger percentage when associated with zinc than when alone, but the reverse effect does not seem to be proved for in one test the same amount of zinc was absorbed regardless of the presence of manganese Again the two metals have a catalytic action and thus influence the total absorbtion of mineral elements by the spore, and even small amounts of the metals will produce this effect Even in the higher orders of plants manganese fertilizer increases the amount of ash The above results bear out the author's theory that the rare elements of the organism are far from being without physiological interest, and are not even to be taken as simple energy exciters of the protoplasm, but are in fact active elements of the cell and are catalyzers which are necessary for the chemical actions of living bodies.

Automobile

Brake Capacity and Efficiency—As the result of recent experiments by Prof C B Veal of Purdue University it has been demonstrated that for greatest all around efficiency the brakes of a car should be designed in the proportion of 1 square inch of braking surface to every 10 pounds of gross car weight In this respect efficiency is taken to mean sufficient retarding capacity to bring the car to a stop from full speed within a reasonable distance without excessive over-heating Larger brakes it is pointed out are inefficient in that they are liable to lock the wheels easily thus reducing retarding capacity and causing undue tire wear

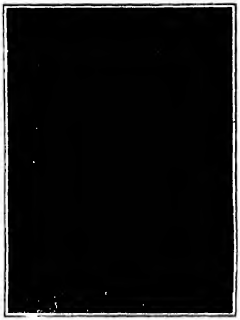
Improved Winter Wheel for Trucks To obviate the skidding proclivities of steel wheels on snow-covered roads and to eliminate comparatively expensive rubber tires a manufacturer of commercial vehicles has developed a new type of tire composed essentially of rope fiber The rope is cut into sections approximately three inches in length and after being impregnated with pitch the sections are subjected to hydraulic pressure to impart to them the required curvature and homogeneity Afterward they are fastened within the steel felloe channels by the simple expedient of bending the edge of the channels inward It is said that mileages upward of 6 000 can be obtained and that the rope tires are inexpensive and easily attached

'Bus Lines for Rural Use—It is the opinion that the present development of the gasoline omnibus which is now such a success is to have quite an influence upon the question of passenger traffic upon roads Heretofore we have been familiar with light electric or steam railroads for use in the country districts but it often happens that there is comparatively little traffic on such lines In some cases the estimated profits from such roads are not enough to warrant a great layout of capital so that here the power wagon omnibus will fill the needs in the best manner An example of this is seen in Italy where the bus lines are developing considerably throughout the country so as to avoid sinking a great amount of capital which it would be difficult to secure The present question applies to local traffic as well as to tourist lines

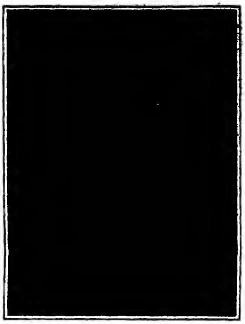
Benzol as a Corrector of Fuels—Great as is the attention that has been directed toward benzol abroad as an alternative fuel for gasoline engineers would seem to have overlooked the fact that it is as a corrector of the heavier distillates that the coal-tar product really is most valuable It has given a great deal of satisfaction alone it is true but its continued use results in comparatively heavy deposits Combining benzol with kerosene on the other hand improves both fuels for it has been demonstrated by experiment that where only mediocre results can be obtained with kerosene alone the addition of from 10 to 50 per cent of benzol materially improves both the efficiency and the economy of the engine A possible explanation of the fact might be found in the greater volatility of the benzol which thus assists in the vaporization of the heavier oil which in turn burns more cleanly due to the greater portion of carbon introduced by the benzol

Warning Conveyed by Engine Starters—Despite the very evident advantage of the many forms of engine starters which during the past year have sprung into such prominence particular reference being made to electric devices their use may conduce to higher instead of lower fuel bills unless due care is taken That is to say it is such a simple matter to start the average engine with such a device the owner easily may overlook the fact that his carbureter is not properly adjusted for greatest efficiency and this is particularly so with the varying densities of present-day fuels Where the old fashioned hand crank is used the effort required to start the engine may serve as an indication of the adjustment of the carbureter for proper adjustment means easy starting With the coming of the engine starter however this means of judging of adjustment, even if it is comparatively rough is lost

New High-speed Gasoline Engine—A new type of internal combustion engine designed to run at the extraordinary speed of 4 200 revolutions per minute, has just been put on the market by an English manufacturer While it is chiefly intended for aeronautic use, a similar model for automobile use is in preparation The engine has eight steel cylinders of 2½-inch bore and 2¼-inch stroke arranged in V shape on a tubular steel crankcase On the end of the crankshaft is a spur gear which drives a large reduction gear having a ratio of six to one The cylinders are set on the crankcase in staggered fashion The motor develops fifty horse-power at the normal speed of 4 200 revolutions per minute and weighs complete only 112 pounds, it works with a compression of eighty pounds per square inch The engine was designed by Granville E Bradshaw who a few months ago turned out a motorcycle engine of the two-cylinder opposed type which ran at 6,500 revolutions per minute and developed 13 horse-power.



Parting of the north wall in the north transept



Serious cracks in the south window, east side.

Bad break in the west wall of the north transept.

Saving a Cathedral With a Diver

How Winchester Was Furnished With a New Foundation

By J W Overend

ONE of the earliest and most famous of English cathedrals is Winchester, second only to the historic Westminster Abbey in London as a national shrine It was built by William of Wykeham statesman, prelate, and a master builder in 1070 It took some fourteen years to build. To this day much of this Norman builder's work remains as he left it, particularly in the north and south transepts, in the cores of the piers, and the walls of the nave, and in the crypt But some of it represents the reconstruction which was rendered necessary by the fall of the central tower in 1107

The Normans were great builders, and they spent little time in designing, for they must have had their designs ready during a period of an initial building age never before witnessed in England There might have been no time to dig properly for the foundations, or to find out if the ground on which they intended should be the base of the great cathedral, was safe or worthy to support the huge structure which reposed upon it.

The great minster must be reared, the long nave stretching ten, twelve, or even fourteen bays, the transept, the choir with its great apse must arise, and the lantern tower above the crossing of the transept upon its four great piers. It seems as if Wykeham thought his piers too large in area ever to be pressed down into the earth, and too mighty ever to be burst asunder His confidence in his erections was complete and his faith unlimited

But the impression was false, and not lasting. The duration of very many of these massive works was short indeed, and the appearance of rock like solidity altogether misleading. The huge piers are mere cases of external pick wrought stones filled with rubble generally, imperfectly grouted together

So it came to pass that the Norman central towers in most cases either soon fell down, or had to be rebuilt, or buttressed up, in order to avoid the ruin which their fall would otherwise have caused, and Winchester was among the cathedrals to have their towers rebuilt.

From the very beginning of the building of the cathedral it has had tremendous troubles, and its history has been marked with disaster owing to the unfortunate selection of a poor geological site of marl and peat on which to erect it. The appearance of ominous cracks in the walls, vaulting, and crypt caused those in power to take very serious steps in the spring of 1905 to remedy the defects, and to get at the root of the evil.

The work was taken in hand by Mr T G Jackson, a distinguished English architect, whose work in the restoration of Eltham Palace, Bath Abbey, and other notable buildings of historic interest place him in the front rank of authorities on the preservation of old buildings.

The impression of the architect is that the pile began to settle as soon as it was finished, and it has, of course, been getting worse as years and centuries have come and gone. The walls, especially on the south side, had also bulged outward, the inclination from the perpendicular being in one part as much as two feet in forty-four, and in another place an inch in a foot.

Diver at work on the cathedral foundations.

A wide crack in the south transept, [illegible] surface, [illegible]

The method of arriving at the cause of settlement has been unique and in fact it is questionable if ever a cathedral has had a new foundation inserted after standing through a period of centuries like Winchester. Under direction of the architect, Mr Jackson, a pit was dug on the south side of the eastern extension of the choir Beneath a 10-foot depth of topsoil a marly clay of 3 feet thickness was reached, and in this stratum was found a raft of beech logs, placed horizontally in two cross layers. Below the clay was a layer of peat, and beneath that a gravel bed charged with clear water free from mud. This was the direct cause of the mischief. Water existed in the subsoil, and under the enormous pressure the peat had yielded, causing the walls to sink and to be thrust out by the pressure of the vaulting. The peat bed was found to be 8 feet 6 inches thick, but directly under the footings it was compressed to about 6 feet. The compressed peat really formed lignite. The building had sunk from 2 to 2½ feet.

In order to remedy the defective foundations the walls, vaults, etc., had to be carefully underpinned down to the gravel below the strata of peat. The water rose in the pit to the top of the clay deposit. The architect consulted Mr Francis Fox, a celebrated civil engineer, whose success in solving the water difficulty in connection with the ventilation of the Simplon Tunnel in Switzerland stamped him as being the man to handle the Winchester problem. On his suggestion, a diver was employed, and the following mode of working was pursued

First the walls of the cathedral were well grouted to fill up all the cracks. Then the foundations were attended to in sections of 5 or 6 feet at a time. [illegible] were dug through the topsoil, exposing the foundations. Then with the aid of ordinary excavating and light pumping the clay and some of the peat was removed until it was necessary to stop pumping, after which the diver entered the hole and removed the remainder of the peat, running drifts under the walls from [illegible] feet long. Bags of ready mixed concrete were then lowered down to him with which he paved the excavation, cutting them open to allow the material to spread over the surface. After four layers of bags were laid and the material had been allowed to set it formed a barrier to further inflow, and the water was pumped out of the pit. Then the foundation work was continued by ordinary masons and bricklayers.

It is worthy of note that the beech logs which formed the raft on which had slumbered the walls of a great English cathedral for centuries were in an excellent state of preservation, considering their position.

We are indebted to Messrs. [illegible] Ltd., for the above information, and for data from which the accompanying drawing was prepared.

The work is now finished. The cathedral will [illegible] for future time, and remain one of those [illegible] inseparably link the old with the new. [illegible] proud of its old time [illegible] particularly of Winchester [illegible]

Air Resistance to Falling Bodies

By A. A. Somerville

EARLY in the spring of 1919 there appeared in the SCIENTIFIC AMERICAN an advertisement asking for college men to make measurements of the time-rate of falling bodies over long distances of free fall. Such an advertisement as this, in which it was stated that the work might be done during vacation time, naturally brought a great number of replies, the writer of this article being one of those interested.

My correspondent and man back of the entire plan proved to be Mr George Cleveland Hicks of Chicago, Illinois. Mr Hicks is primarily a business man, a director in an enterprising corporation. Aside from his business interests he is interested in the laws of nature, and is willing to spend his money to study and have others investigate for him.

For several years Mr Hicks has been interested in the subject of falling bodies, and especially in the rate of fall over long distances. He still has experimental notes taken twenty years ago, and adds to them all the while. This last year he has obtained the first real accurate evidence to verify his own private opinions on the subject, and he has had many different people at work for him in as many different places.

The laws of bodies falling under gravity alone, as first determined, are still used in practice to-day The most commonly used equation is of this form

$$S = \tfrac{1}{2} g T^2 \qquad (1)$$

Equation (1) reads like this—the space through which a body will fall in a given time is equal numerically to one half the value of the acceleration of gravity, multiplied by the time squared

Now the value of the acceleration of gravity is equal to the force necessary to support a unit amount of material in free space, or it is the change in velocity that a body will acquire if allowed to fall from rest during one second, roughly this is 32 feet per second, so we will say that the value of $g = 32$ numerically without attaching any time or space units to it as a physicist would do

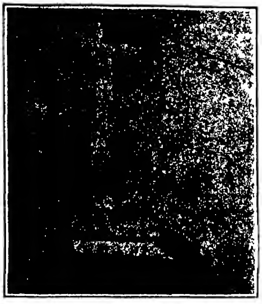
Now putting that value into our equation we have $S = \tfrac{1}{2}\ 32\ T^2$, and if we suppose a body falls during a time of 5 seconds then $S = \tfrac{1}{2}\ 32\ (5)^2 = 400$ feet. But if we try the experiment we will find that the body will not fall so great a distance in five seconds time

There are two or more reasons for this—they are air resistance and air buoyancy The latter is negligible unless very light bodies such as feathers or balloons are dropped, but if metal bodies are dropped the buoyant effect of the air is only about one hundredth of one per cent of the force of gravity, and so any retardation of the rate of fall of the metal body is negligible.

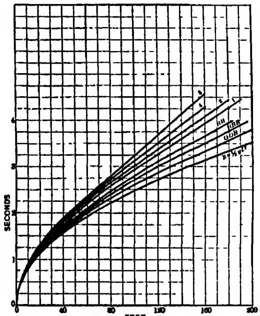
The other effect which causes retardation is that of air resistance. That is, the falling body must push the air out of its vertical path downward, and at high speeds this becomes a very considerable force. High speeds can be had in freely falling bodies only by using long distances. There are scarcely any data available on the subject. Prof. Hall of Harvard has done some work in his own laboratory Attempts had been made, but without success, to secure the privilege of trying the experiment in the Washington monument.

The writer, with the assistance of others, worked on the problem this past summer at Toughannock Falls, New York. At that place there is a ravine with cliffs on either side 360 feet high. The gorge is 400 feet wide. A cable was stretched across from cliff to cliff and anchored. On this cable was a pulley which could be located directly over the middle of the gorge or at one side of the small stream at the foot of one of the cliffs. From this pulley a double line extended to the bottom, and by means of this line a steel measuring tape, a box with drop door to contain shot, marbles, bullets or similar objects to be dropped, and an electro-magnet with lead wires reaching to the ground, all could be raised to the height of the cable at the top. Through the lead wires extending to the ground a current could be sent through the electro-magnet, thereby opening the trap-door in the box and allowing the bodies therein to fall over a distance of 360 feet. Distance was measured accurately with the steel tape. Time was recorded on a chronograph or revolving cylinder covered with paper on which a pen marked. This pen was controlled by another electro-magnet in the same circuit as the one on the cable above, so that a signal was made on the chronograph at the instant the body started to fall. The falling body was caught in a sheet at the bottom at the end of the fall, and when it struck this sheet the impact was sufficient to jerk the sheet at the corners where it was fastened, and thus by means of electrical contacts make a signal on the chronograph through the electro-magnet operating the pen. Actual time of fall could in this way be read to the hundredth of a second.

Knowing the value of gravity, the space, and the [illegible] could be made in the equation, [illegible] that equation



Box from which shot was dropped and sheet in which it was caught



Time of fall for shot of different sizes.

The Toughannock Falls and cable stretched across for use in the experiments with falling bodies.

Glass balls, loaded glass phials and shot of various sizes were used for falling bodies. Later in the summer more data were taken at two other places where air currents were not so troublesome

A set of curves was plotted showing the time required for shot of different sizes to fall a given distance

It is to be hoped that Mr Hicks will continue these experiments, and so be able to furnish further data on the subject

Moor-burning in Germany

A COLOSSAL "smoke nuisance," from which the greater part of Europe once suffered more or less, is now rapidly abating with the decadence of the time-honored German custom of burning the moors. This custom, together with certain atmospheric phenomena to which it gave rise forms a curious chapter in the history of German agriculture

About three per cent of the total area of the German Empire is moorland, i e a soil consisting of peat formed by the partial decomposition of mosses and other vegetation, and in its natural state unfit either for cultivation or grazing The problem of utilizing the moors, both in Germany and in the other countries of northern Europe, has received a wholly satisfactory solution in recent times, thanks to the efforts of numerous moorland experiment stations, moor commissions, societies for moor culture, and so forth Several scientific methods of moor culture are now in vogue and there is a large literature on the subject in German. The problem is, however an old one, and was partially solved centuries ago by primitive methods, one of the most popular of which was moor burning. The great stronghold of this custom, which was introduced from Holland at the beginning of the eighteenth century, was the district in the northeastern corner of Germany called East Friesland, and here it still flourishes to some extent

The essential features of the process are as follows The land is usually first drained by open ditches, in order to dry a shallow layer of surface soil. In the autumn the turf is pared off with large hoes, the sections being turned over or set on end, and allowed to dry all winter During a spell of dry weather in May or June the clods of turf are piled in heaps and set on fire The fire is generally started on the leeward side of the pile, in order to ensure slow and thorough combustion The results of this process are that the land is cleared of waste vegetation, a layer of ashes is spread over the moor, and the underlying ground is improved in its hygroscopic and chemical constitution by the heating which it undergoes. The land thus prepared is generally sown at once to buckwheat. After the harvest the whole process is repeated, and another crop is grown the following year No fertilizers are applied. It is found, however, that the productiveness of the land diminishes year by year, and after six or seven years the moor is burned dead It must then be abandoned, and requires 20 or 30 years to recuperate As compared with the modern methods of thorough draining, rolling mixing with the subsoil, and otherwise permanently reclaiming the moors, the burning process is so wasteful of land that it has generally been given up except in districts remote from settlements, where the cost of the land is insignificant.

One of the most serious objections to moor burning is the huge volume of smoke which results from the smudging of the imperfectly dried peat This smoke is carried by the wind for hundreds and even thousands of miles. There is a saying that 'when the moors are smoking all Germany smells it,' but this hardly expresses the matter fully, for there are many cases on record in which the smoke from the North German moors has been observed in the form of a characteristic haze—the so-called 'dry fog' or 'moor smoke'—as far away as Spain Italy, and Greece. This phenomenon is analogous to the smoke-haze from forest fires so often observed over vast areas of the United States in autumn.

In the vicinity of the burning moors the smoke is a downright nuisance, and has led to the formation in Germany of a number of anti smoke societies whose efforts have hastened the passing of this primitive custom.

Useful Cements

ONE of the simplest hard cements is the well known mixture of litharge and glycerine made to a stiff paste. It sets hard as a rock, and is oil proof A solution of water glass mixed with powdered calcium carbonate serves the same purpose.

A mixture of boiled linseed oil and fire clay resists acid better than most cements, though sulphur melted with glass powder is also ranked as very resistant to chemicals in general.

A good stone cement is made by mixing two parts of magnesium oxide, one part of magnesium chloride, powdered stone to suit as a filler and water to make a stiff paste Basic magnesium chloride is formed

New Light on Diabetes

MOST people think of diabetes as a kidney disease This is erroneous. Diabetes is a disease whose characteristic symptom is an excess of sugar in the blood This excess, the kidneys work hard to remove To hold them responsible is as absurd as to blame the thermometer for extremes of temperature'

Soluble sugar is a vital necessity to the organism, but an excess is a dangerous poison which must be excreted.

The latest investigations of sugar metabolism show that the formation and excretion of sugar depend on a very complicated and delicate balance of the operation of several organs, including the central nervous system the sympathetic nervous system the pancreas, the supra renal glands the pituitary body the thyroid gland and the epithelial bodies Any disturbance of this balance which is attained by a delicate adjustment of controls," may lead to the presence of an excess of sugar

The value of these discoveries, which are very clearly stated by Dr L. Reinhardt in *Prometheus* is inestimable since they afford hope of an earlier diagnosis and prompter treatment of a particularly insidious *malady*

The chief source of sugar in the body is the starch consumed in bread and other cereal food and potatoes and other vegetables. Only a small part of the sugar we need comes to us in soluble form, as of grape-sugar, milk sugar, cane-sugar, and fruit sugar These enter the blood directly because of their solubility, but the starches, which are insoluble in water, must be acted on by digestive ferments and transformed into sugar before they can be thus taken up and carried to the various tissues. This is partly accomplished by the saliva, but chiefly by the pancreatic juice in the small intestine, after the food has passed the stomach. From here the sugar passes first to the liver and afterward enters the general circulation, to be carried to various parts of the body, being especially required by the muscles

'If now the provision of sugar exceeds the current demand, the excess is stored up, partly in the form of insoluble animal starch (glycogen), whereby water is eliminated, and partly in the form of fat The latter is stored in the greatest variety of places, the former chiefly in the liver and muscles.

Animal starch is formed not only from starch and sugar, but from albumen, when an excess of this is furnished by such food as meat and eggs but the amount thus formed is insignificant compared to that from the so-called carbohydrates"

Hunger and labor both diminish these stores in the organs, the liver and muscles first answering the demand The process is so neatly adjusted in the healthy body that despite the large variations in the amount of carbohydrates consumed, on the one hand and in the output of energy, on the other, there is never a great excess or decrease, the percentage of sugar in the blood remaining steadily between the narrow limits of 0 1 per cent and 0 15 per cent

It is only when the body loses its power of burning sugar in its tissues that the sugar content of the blood is unduly augmented, and must be removed Naturally the kidneys, like other organs, may suffer degeneration through overwork

'When, by reason of increased use of sugar, the sugar-content of the blood threatens to fall below the normal the liver and other depositaries of animal starch, such as the muscles, receive the order to transform some of this into soluble sugar and supply it to the circulation. This message is transmitted by the so-called '*chromaffinic*' system, which is specially located in the supra renal glands. The blood then brings the sugar to the place where required and gives it up to the needy cells If the chromaffinic system falls of its function because of some affection of the supra renal glands, as in Addison's disease, the sugar content falls below the normal '

But here another factor must be considered, in the action of the pancreas. This gland is antagonistic to the supra renal glands, in that it exerts an inhibitory influence upon sugar formation in the liver and other depositaries. Hence, the pancreas and supra renal glands tend to control each other, thus preserving the needed balance But if the pancreas becomes diseased, while the supra renal glands remain sound, the result will be an excess of sugar in the blood

But both pancreas and supra renal glands are themselves controlled by other regulators. The pancreas is subject to an inhibition from the thyroid gland. When this is unduly large the pancreas is checked in its function of limiting sugar production in liver and muscles. Hence, the too free metabolism of animal starch into sugar causes an excess of the latter and more work for the kidneys "Consequently, we often observe the presence of sugar in the urine of patients suffering from an enlarged thyroid, as for example Basedow's disease, or 'goggle-eye' This malady lowers the capacity to burn sugar

Conversely, if the thyroid is insufficiently developed the pancreas is insufficiently checked in its inhibitory action on liver and muscles, with the result that the 'limit of tolerance' for sugar is raised. In this case even a large superfluity of carbohydrates in the diet will not cause elimination of sugar, since the sugar content of the blood is diminished.

"The supra renal glands, on their part, are under the control of the sympathetic *nerve system* The French investigator, Claude Bernard, showed nearly two generations ago that the sticking of a needle into a certain spot in the *fourth* ventricle of the brain was followed by the excretion of sugar in the urine, because the irritation thus induced passed over the *Nervus Sympathicus* to the liver and accelerated sugar formation But this stimulus to the liver from the central nervous system goes by way of the supra renal glands.

Claude Bernard's 'Puncture Diabetes' is in fact a purely supra renal diabetes.

"To these correlations must be added the effect of the pituitary body, and that of the epithelial bodies of the *accessory* thyroid gland The pituitary body acts in the same way as the thyroid, while the epithelial bodies (or epithelial corpuscles) act antagonistically

'Hence, the enlargement of the pituitary, as seen in acromegaly and the closely related 'giant growth,' occasions a lowering of sugar tolerance, precisely as does an enlargement of the thyroid, while on the contrary, the enlargement of the epithelial corpuscles causes an increase of sugar tolerance"

Even these elaborate reactions do not cover the full complexity of sugar metabolism, since some questions remain to be solved. But it is obvious that sugar in the urine may proceed from a great variety of causes, making the need of skilled diagnosis imperative.

A Remarkable Flight in the Far East

THE aviator *Marc Pourpe* made an aeroplane flight which is quite out of the ordinary during his stay at Singapore, flying in a brilliant manner across the island of Borneo, which is entirely covered with wooded tracts made up of cocoa and rubber trees, then flying above the Sultan of Johore's palace, this being situated on the other side of the strait, whose width is three miles. This flight is said to be the most dangerous which has yet been attempted, although the distance is only about 60 miles. It is also the longest aeroplane trip to be made in the tropical regions. The Sultan of Johore offered the pilot the sum of $600, and the Singapore Sporting Club raised a prize of about $2,400 for the flight.

Live Frozen Fish

TRANSPORTATION of live fish is an expensive matter from the fact that it requires from 1 to 4 gallons of water per pound of fish according to the kind, so that a railroad car having 10 tons limit for the load can transport only one half to one ton of live fish. Messrs. Mir and Audigé now use a method of freezing the fish in blocks of ice according to Pictet's experiments, and can now transport a large quantity of fish in a relatively small weight of ice. The fish are at first contained in a large amount of water, then while the tank is placed in a closed space oxygen under pressure arrives upon the water, so that the *greater* part can now be drawn off and the fish remain in good condition in a very small amount of water, as the oxygen supplies their *respiration* Freezing is now done by plunging the vessel with the fish into a refrigerating tank, and in this way an ice block is obtained in which the fish are frozen, but will come to life again when thawed out. The block is wrapped around with suitable coverings and on the outside is put a heat-protecting jacket, then the block is ready to be placed on the car In practice, such blocks can be piled up in refrigerator cars whose temperature is kept near the freezing point. Upon arrival at their destination, the fish are put through a very slow thawing process, which lasts for about ten hours. The inventors claim that this saves heavy and bulky liquid and there are no complicated or costly devices needed, the process being a simple and cheap one.

Artificial Diamonds

A PARIS engineer, E de Boismenu, claims to have produced minute diamonds by an electric furnace process, the largest of the specimens measuring nearly one tenth inch. Naturally the announcement of such an important discovery has made somewhat of a sensation and gives rise to some incredulity as well, but the author has now published a brochure on the subject in which he gives a very complete account of his method, for which he has taken a patent. We expect to give a description of the process and show some photographs of the specimens at an early date, but would mention at present that the specimens have been seen by some well-known scientists, also jewelers, and they identify them with real diamonds. Naturally they were put through all the necessary tests in this case. The process is based upon the electrolysis of calcium carbide in the electric furnace by the use of direct current, and the carbide is decomposed in such way that one of the poles becomes surrounded with a blackish and spongy substance in which a certain quantity of minute carbon crystals or diamonds are observed, and these are separated by pulverizing and washing the substance. The experiments were made on a small scale, as lack of means prevented further work, but the inventor expects to resume them soon. What is encouraging is that the size of the diamonds increases with the length of time the furnace is left running, so that there is reason to believe that much larger specimens can be obtained. *The* SCIENTIFIC AMERICAN will soon publish an article on the Boismenu process.

Preventing Bread from Getting Stale

FOR thousands of years mankind has been content with allowing its bread to get stale, and this fact has come to be considered unavoidable. It is the more surprising that researches by Dr J R. Katz at the Physical-Chemical Laboratory of the University of Amsterdam, should have shown that there is in point of fact no need for allowing our bread to lose its toothsomeness. When kept either at a very low or very high temperature, bread is in fact preserved "new" for some days at least, staleness being due only to the ordinary temperatures of bread storage and consumption.

In connection with Dr Katz's experiments, bread was kept absolutely new for more than 40 hours at a temperature of 60 deg Cent., while at a temperature of 30 deg. to 40 deg it became only "half stale" At ordinary temperatures it of course grew rapidly stale, in order again to become "fresh' at temperatures below freezing point.

Dr Katz accordingly recommends keeping the newly-baked bread at temperatures of 50 deg Cent. and upward, thus keeping the crumb absolutely new whereas the crust by absorbing water becomes limp and flexible. If the bread be then put back again into the oven for a short time the crust will give up its water, thus becoming hard and crisp as before An even simpler course is preserving the bread in cold storage rooms kept at sufficiently low temperatures. If these rooms be sufficiently dry, the crust likewise remains hard and crisp so that the bread even after a considerable time is equivalent to new bread.

Apart from its importance to the housewife this process is of the highest economical interest, relieving as it does the baker of the necessity of baking his bread by night.

How to See Through Opaque Paper

A VERY remarkable experiment which any one can repeat with very little trouble has been unearthed by a contributor to *Prometheus*, in an old number of the *Mechanics Magazine* of the year 1829. Take a piece of paper of such thickness that, when it is laid upon a piece of printed matter the characters just show through, but cannot be read. Placing it over a printed sheet impart to it a circular motion to and fro, and to your surprise you will find that now you can read the print below the paper It is rather difficult to explain this peculiar effect. The explanation offered in *Prometheus* is that the paper has a number of thin places in it, and by rapidly moving it over the print, every part of the printed matter is exposed in turn underneath one or the other of the thin places in the paper and thus the entire print can be read. However, that may be, the experiment is interesting and very simple, requiring for its performance only the simplest means imaginable

The Current Supplement

GRINDING wheel sparks are not only a somewhat spectacular accompaniment of the use of the wheel, but may be turned to useful account, as their appearance gives a clue to the initiated of the character of the steel from which they are struck. This point is illustrated by R. G Williams in this week's issue of the SUPPLEMENT—It will be remembered that in 1907 the Quebec bridge over the St. Lawrence River collapsed while in the course of construction. The plans adopted for a new bridge by the Canadian government are critically discussed and compared with the author's own design of Prof. G. Kriwoschein of St. Petersburg. —Some deceptions practiced upon the unwary buyer of scrap metal are laid bare.—A simple method of measuring the height of an aeroplane is described.—The concluding lecture of the series delivered by Sir J J Thomson on the Structure of the Atom appears in this issue.—A new vacuum gage of extreme sensitiveness is described by Irving Langmuir.—A. D. Watson writes on Calendars Ancient and Modern.—An important paper, "Problems in Wireless Telegraphy," by Prof. J. A. Fleming is presented in full.—Prof. J. Watson Smith's report on the [illegible] in the [illegible] set by the [illegible] is [illegible] in this issue.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Inventors and Technical Schools

To the Editor of the SCIENTIFIC AMERICAN:

Mr. Kennedy's letter on page 287 calls attention to a most needed thing The progress of any country depends largely upon developing new wealth, and your article on Inventors and Inventions quite clearly brings out this fact. Unfortunately, American manufacturers are not fully awake to this matter, or they regard the expense of development as beyond them, which in many cases it doubtless is. The Germans are doing much better than we in this respect. Possibly because labor is cheaper

We have, however, means at hand that could be used if proper agitation and education is made along this line. I refer to our technical schools. Manual training is being adopted by many schools, so that the student is given practical work along with his theory These students contain a large available supply of muscle and brains which could just as well be employed on new work as in doing more or less useless work, as often happens now. If inventors could arrange with the school to develop the invention, the school would get the advantage of its students' work on something that requires advanced thought, while the inventor would get the advantage of the apparatus, experience, and theories which the school can give him I think some work of this kind is done now, but I do not know of any recognized, equitable plan under which it is done, nor of any arrangement for protection of the inventor, on which account he usually prefers to keep his invention to himself until perfected sufficiently to apply for patent If the school could receive a certain percentage for developing the device and for assisting the inventor to market it, this matter could be profitable to the school and inventor both.

Saginaw, Mich CHARLES E DURYEA

The Need of a Bibliographical Institute

To the Editor of the SCIENTIFIC AMERICAN

Your editorial, "What the Rich Man Might Do for the Scholar,' is very much to the point You ask, "Why not found a bibliographical institute?" Perhaps the reason why it has not been founded is that it does not appeal to the imagination in the same way as does a library But you are quite right in pointing to this as a matter of greater importance than the multiplication of libraries. An institute for bibliographical research, such as the writer has advocated for many years, would supplement and aid the work of libraries and would result in a national organization of what might well be called the foundation of all knowledge, for bibliography answers the question "What do we know about this matter and how did we arrive at the present knowledge?" Anyone who tries to answer such questions will necessarily use *bibliography* as a means by which his problem must be solved.

It is now nearly twenty years ago that the writer, in a paper read before the New York Library Club and afterward published in the *Library Journal*, advocated an organization of bibliographical work through a pooling of the interests of a number of the larger libraries for the purpose of making their resources in many special fields more generally available.

Since then the subject has received the very closest attention on my part, and I have repeatedly brought it to the attention of libraries, bibliographers, and other scholars. From nearly all quarters the proposition has met with approval and interest, the need of a bibliographical institute in the interest of scholarship is fully appreciated by those who would benefit by it.

Men of wealth have been approached through various channels in an effort to find someone who would come forward to assist this important movement, but so far in vain.

An effort is now being made to interest business men in the subject. Efforts are being made to show that bibliography can be made of direct service to the business community This circular has been sent out to a number of prominent business men in Chicago calling attention to the value of research along these lines for both agriculture, manufacture and commerce. A "Committee on Research Institute" has been formed for the purpose of promoting the idea.

While the latest endeavor has been made along the line of business, the intention of the writer is now, as it has always been, that the only limits to the scope of the proposed institute should be the actual needs of those who might seek its assistance.

The functions of the proposed Research Institute would be entirely practical. The institute itself would be in readiness to make researches into definite subjects at the request of those desiring special information, it would also try to anticipate the needs of inquirers, and compile references on subjects of actual interest in advance of demand.

The writer has often been asked what relation this proposed Bibliographical Institute would have to the other institutes of this kind, notably the Institut International de Bibliographie at Brussels, and the International Institut for Sozialbibliographie, and allied institutions, at Berlin. The answer is that it would supplement them and, as far as possible, utilize their material The Brussels Institute collects titles of all kinds, from all sources and of all dates, the Berlin institutes collect titles from the current year on a limited number of sciences. The institute which the writer proposes would have for its object to collect titles from all sources and of all dates on a definite number of subjects, concerning which information is actually wanted.

While an institution of this sort should be independent, and not affiliated with another, for instance one of our large libraries, it might very well be organized in connection with a new kind of library, a library for libraries, containing books and periodicals too expensive and too little used for the ordinary reference or college libraries to possess them. The establishment of such a library has been advocated several times.

If anybody who reads the above should be willing to assist in any way in furthering the interest of bibliographical research along the lines suggested, he should communicate with the undersigned.

AKSEL G S JOSEPHSON
Chairman Committee on Research Institute
Chicago, Ill

The Fallacy of Flexible Fabric Wings

To the Editor of the SCIENTIFIC AMERICAN

I have read with much interest Mr Grant Linton's letter on aeroplane design in your issue of March 1st, 1913 In the present stage of the science every suggestion, if not too obviously absurd, is entitled to serious consideration Nevertheless, Mr Linton's reasoning seems to be based on such an astounding lack of knowledge of the commonest facts of aerodynamics, that I am forced to doubt the validity of his conclusions

For instance, he tells us that the forces acting on his piece of fabric are its weight, downward, and the wind backward, but he overlooks the third necessary factor to equilibrium, the upward and forward force of the cord or other sustaining means How will he allow for this force in transferring his idea to an actual machine? Then he assures us that the air stream is flowing horizontally as it meets the forward edge of the fabric, apparently unaware that Montgomery proved, as long ago as 1905, by using streams of water sprinkled with light chaff to indicate lines of flow that a current approaching a surface inclined to it at a positive angle is deflected upward to a considerable degree some distance in advance of the surface, which result has more recently been confirmed by injecting thin lines of smoke into wind tunnels.

Next he tells us that "there is of course a decrease in the absolute drift component of the air pressure, proportional to the decrease in the absolute lift" This statement can be true only for very small angles of incidence. If, for instance, the free rear edge of the fabric drops slightly, so that its angle of attack changes from, say, 20 degrees to 30 degrees, there will be a decrease in the absolute lift, but an *increase* in the absolute drift.

In reasoning by analogy from the sailing vessel, Mr Linton says that the sail *automatically* varies to the most favorable form under any conditions of wind pressure and direction of wind pressure This statement is not true. Any yachtsman knows that a sail ought to be brought to a relatively shallow curvature for reaching, and allowed to bag somewhat for running The late A Cary Smith, by means of a contrivance called the reach reef, which enabled the curvature of a sail to be varied manually at will, succeeded in substantially increasing the speed of a number of racing yachts Mr Linton also does not seem to be aware that sails are not efficiently operative at angles of incidence as low as 5 degrees, which is about the maximum now found in efficient aeroplanes. I confess I do not understand just what he means when he says that "in both classes of vehicles the best efficiency could only be obtained by altering the length of the chord" Possibly he is thinking of variable *area*, a device that offers many theoretical advantages. However, Eiffel has demonstrated that about the best length for the chord of an aeroplane wing is one sixth of its span, and no noticeable gain in efficiency can be had by varying greatly from this proportion.

Mr Linton is again gravely wrong when he asserts that "full speed when once attained is as regular as that of the highest types of automatic machinery" The best aeroplane will undulate slightly in its flight path, requiring an occasional touch of the elevator to keep it horizontal, just as a ship, and for that matter, an automobile, requires an occasional touch of the wheel to hold it to a straight course The resulting constant changes in the angle of incidence of course cause a constantly varying drift, and consequently an uneven speed The magnitude of this speed variation will probably surprise Mr Linton very much if he will consult the reports of the speed tests made on a Zodiac biplane at the Aeronautical Institute of St Cyr, an abstract of which he will find in *Aero and Hydro*, vol v page 25 The gentleman does not seem to know that the ability to vary the speed of horizontal flight within wide limits is a most desirable quality of the aeroplane The Cody biplane's ability to vary its speed of level flight between 48 5 and 72 4 miles per hour, a range of 49 4 per cent, contributed largely to its winning of the British military trials

The belief in the parabola as the only correct basic curve for wing sections, a belief which Mr Linton asserts with much positiveness, belongs to the ancient days when we knew absolutely nothing of the actual conditions around an aeroplane wing in flight The belief might be correct if we were dealing only with the principles of dynamics, as a matter of fact, we have to deal also with the properties of a gas, and recent discoveries seem to indicate that effect due to the latter is the more important No successful aeroplane in use to-day employs a wing of purely parabolic curvature. Practically all employ compound and irregular curves, or combinations of curves and planes, the design being wholly empirical, and with such wings they manage to fly fairly well and to return in useful work a very large proportion of the energy expended Moreover, as Eiffel's tests definitely prove, the wings in actual use which are based on the circular arc give on the average better results than those approaching the parabolic form But it is as silly to expect any definite and universally correct curve for a wing section to be discovered as it is to expect that any curve can be always the correct one for the waterline section of a ship's hull

Personally, I have often observed a piece of fabric suspended by one edge in a current of air and I never saw one piece rise to a sufficiently acute angle of incidence for aeroplane use without beginning to flap or undulate This effect is in part due to the fact, first demonstrated by Montgomery, that the air flowing around the curve tends to assume a rotary or eddying motion, strong enough to deform the fabric, and in part due, I believe, to the fact that the fabric is by its structure, uniformly loaded In proposing to uniformly load his full-sized piece of fabric by means of metal bars uniformly distributed over the top surface, Mr Linton is most obviously ignorant of the fact that Eiffel has tested rigid curves of practically every form that the fabric might assume, and in no case has the slightest approach to a uniform distribution of pressure been discovered To, as he suggests, adjust the angle of incidence, and, incidentally, to make the fabric keep still long enough to be photographed, by shifting the weight of the metal bars, would involve an infinite number of trials thus reducing his plan to the "cut-and-try" process which he so scorns in the first paragraph of his letter Eiffel has proved although Mr Linton is not aware of it, that from 65 per cent to 90 per cent of the total lift is due to the reaction of the air on the *top* surface of the wing How will the irregular ridges of metal bars on top of the fabric affect this reaction? And, since an actual rigid wing must have several inches of thickness, how will Mr Linton determine the correct curvature of the upper surface? If he makes the upper surface parallel to the predetermined lower, will he join the two in a sharp or a round edge? Does he know that two wing sections in all respects identical save that one has a sharp entering edge and the other a well rounded entering edge, will give very different values of K_y and K_x-K_y, and different locations of the center of pressure?

As a matter of fact, if Mr Linton were superficially informed on actual aeroplane development, he would know that his idea of flexible fabric wings has already been out and tried The Vlaicu monoplane employs wings of flexible fabric, entirely unsupported by ribs of any sort, and perfectly free to assume any curve impressed on it by conditions of speed and load At the last international meet at Vienna, June 23rd to 30th, 1912, a machine of this type, equipped with a 50 horse-power Gnome motor and piloted by its designer, flew very well, and won several minor prizes But, in spite of the fact that it was lighter than the average one-place monoplane, the best speed it could make was 43 75 miles per hour Inasmuch as there are a great many other monoplanes, equipped with this same motor, of the same horse-power, of generally heavier construction, and using rigid, empirically-designed wings, that are easily capable of speeds from 50 per cent to 90 per cent greater, no further comment on the enormous drift and inefficiency of non-rigid wing surfaces is necessary. JOHN G HANNA.

Galveston, Texas.

A Monster Hydro-aeroplane

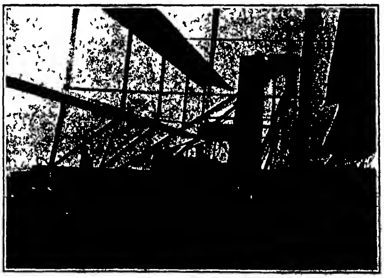
MENTION was made last week in our article on "The Big Aeroplane and the Transatlantic Flight" of a new double biplane that was intended to make its *début* at the Monaco meet.

A good idea of this huge machine is to be had from the photographs which we have reproduced on this page These show two biplanes, one behind the other, mounted by means of forwardly inclined struts upon a 22 foot hydroplane hull A large rectangular, movable surface forms the elevator and is mounted directly above twin vertical rudders at the rear end of a tubular framing which extends from front to rear of the entire machine There is no tail surface the following planes alone being depended upon for the longitudinal stability The spread of the second, or main, set of planes is 24 meters (78.8 feet), while that of the front set is probably 15 to 18 feet less. Both sets of planes are narrow from front to rear the chord being not over 5 feet This is noticeable in the side view of the machine Ailerons will be fitted to the upper rear plane for transverse stability Cylindrical steadying floats are fitted beneath each end of the main biplane as can also be seen in the side view This picture, furthermore discloses the top of one of the two 230 horse power Chenu 6-cylinder motors, which are placed side by side and which drive the single, 2 bladed 14 feet 5 inch propeller in front of the main biplane by means of chains. The inclined radiators extending from the propeller shaft down to the boat can be plainly seen in both illustrations.

This huge water-plane was built by the aviator, Colliex, for M Jeansson Its length over all is 16 meters (53 feet 6 inches), and its weight complete 4,400 kilogrammes (9,400 pounds) It was not completed in time for the meet, but is now about ready for test The result of its trial flights will be awaited with eagerness by all interested in the transatlantic flight for it is some such huge aeroplane that will in our opinion eventually make the 1800-mile trip without a stop Already about a score of men of different nationalities are engaged in designing machines for this great undertaking. A prize of $50,000 has been offered

Three quarter rear view of Jeansson double biplane, showing elevator and twin vertical rudders in foreground.

Side view of biplane, showing method of attaching to boat as well as float below end of main plane.



Details of boat and power plant.

A GIGANTIC AEROPLANE

How to Make Dwarf Trees

HOW gardeners manage to grow miniature pines, firs, and oaks in flower pots for half a century has always been more or less of a secret It is the result chiefly of skillful, long-continued root pruning. They aim first and last at the seat of vigorous growth, endeavoring to weaken it just as far as possible without destroying the life of the tree They begin with the young plant, say a seedling of a cedar or hemlock, when only two or three inches high, and cut off its tap-roots as soon as it has other rootlets enough to live upon and replant it in a shallow earthen pot or pan.

The end of the tap-root is generally made to rest on the bottom of the pan or on a flat stone within it Alluvial clay is then put into the pot, much of it in bits the size of beans, and just enough in kind and quantity to furnish a scanty nourishment to the plant Just enough of water, light and heat is given to keep it alive but not enough to excite a vigorous habit. Gardeners usually pride themselves on the shape of their miniature trees, and they use strings, wires, and pegs, and various other mechanical devices, to promote symmetry of habit, or to fashion their pets into odd fancy figures. Thus, by using very shallow pots, the development of the tap-roots is impossible and by using poor soil and little of it, and little water rapid growth is prevented. Then, too, the top and side roots, which are within easy reach of the gardener are shortened by means of a pruning knife, or are seared with a hot iron In this manner the little tree is headed off on every side and is allowed to grow just enough to live and look healthy Accordingly each new set of leaves becomes more and more stunted the buds and rootlets are diminished in proportion, and at length a balance is established between every part of the tree, making it a dwarf in all respects. In some species this end is reached in three or four years, while in others ten or fifteen years are required.

Some Recent Views from the Panama Canal

THE people of the United States, and of the whole world, for that matter, are greatly indebted to the camera for the good work it has done in keeping them in touch with the progress of work on that great undertaking. Such views as those which are herewith presented afford an excellent impression of the magnitude, stability and high character of the construction. Now that the great work is practically completed, the photographs become highly instructive.

Of the views presented herewith, the most interesting will be that showing Gatun Lake, which during the past year has been spreading far and wide over the valley of the Chagres River The formation of this great inland sea—for it is nothing less—is the key to the whole Panama problem. By its formation, the turbulent Chagres River, which in the earliest days of the work caused the engineers so much anxiety, particularly during the French and the earlier American control of the work, has been brought into subjection and made to serve a great and useful purpose. The impounding of the waters of the river by the dam at Gatun has not only eliminated a large amount of otherwise necessary excavation, but it has afforded some twenty miles of deep water navigation, and in the stretch of the lake which is shown in the view above referred to, it will be possible for steamers, if they so wish, to proceed for several miles after they have passed through Gatun locks at full speed. The view is taken from the southerly end of the locks, looking south over the central guide wall which forms a continuation of the middle wall that lies between the two adjoining sets of locks. On either side are seen the tracks for the towing locomotives, with a central track for the return of the same after they have taken a ship out, or as they proceed to the end of the wall to take a ship in tow

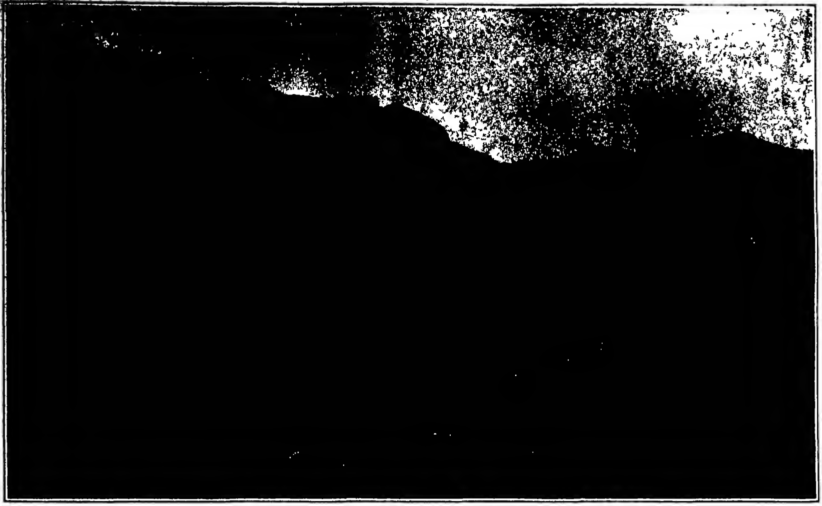
The massive, bridge-like structure shown in another view is the upper portion of what is known as the emergency dam. This is nothing more nor less than a counterweighted swing bridge, similar to those which span the main channel when railroad bridges are carried across a navigable river. Should an accident occur to the locks, such as might be occasioned by a ship colliding with and breaking down the gates, this swing bridge would be turned until it spanned the entrance to the locks. Then a series of heavy, vertical girders would be lowered, until they extended from the bridge down to footings at the bottom of the entrance, and upon these girders large square steel plate slabs would be lowered, tier above tier, until the whole channel was closed and passage of the water out of the lake prevented.

Very impressive and instructive is the view of the upper guard gates of the easterly side of locks at Gatun The structure as shown is complete, with the footbridge for crossing the gates in place. At the top of the gates at each end, and immediately below the footbridge, will be seen the two massive steel arms, each five tons in weight, by which the gates are swung open or shut. The arms pass beneath the surface of the side wall of the locks to connect with a large gear wheel, electrically operated, the gear being so powerful and well proportioned that the gates are handled with ease and great accuracy of control The gates are seven feet in thickness and are hollow and watertight in their lower portions. They are made hollow to give them buoyancy, so that the greater part of their weight, which in each leaf runs from four hundred to six hundred tons, will be waterborne The square holes which are noted about mid height of the gates, as seen above water, enable the water to pass within the upper portion of the gates, and prevent them from a tendency to rise when the water is at the eighty seven foot level

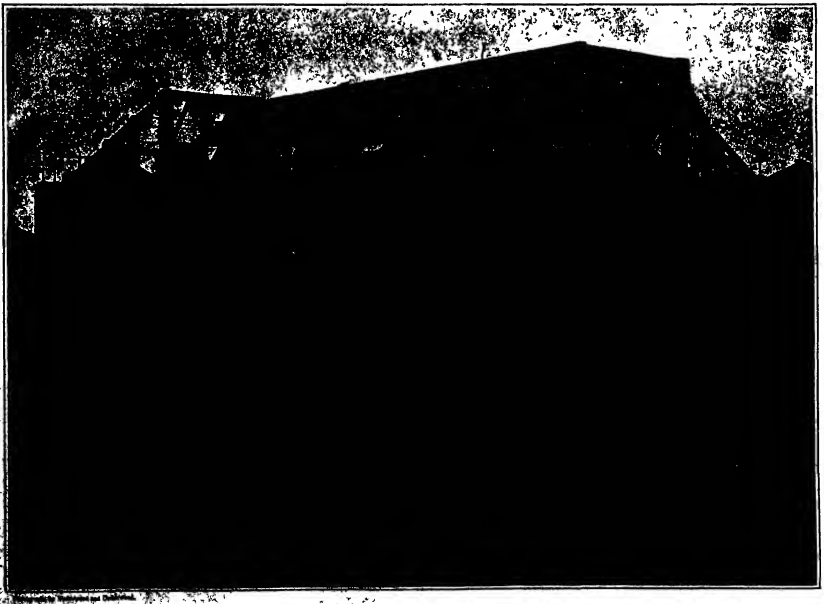
The photograph of the big slide at Culebra explains very clearly why it is that the lofty sides of the cut at this place refuse to stand at the original slope the engineers intended. It will be understood that as the bottom of the side of the cut is crushed under the great load overhead, the material breaks up, losing its consistency, and becomes practically a mass of muck with very little consistency Troublesome and costly as these slides are proving, Col Goethals has stated that they will not delay the opening of the canal—so great is the capacity of the excavating machinery, which, as the big cut is being cleaned up, will be concentrated in full force at this particular location.

Ski-making in Norway

THIS is the latest out-of-the-way industry to be described in the versatile American consular reports. The consul general at Christiania states that Norwegian skis are not made in factories, but by carpenters who devote all their time to this pursuit, in summer laying up a supply for the following winter. They make them in their homes, by hand, and sell direct to the users or to retail stores. Lately Germany has begun to make skis by machinery. The best skis are made of green ash, the next best of oak, and the cheaper grades of fir and pine. They vary in length, the rule being that skis should be as long as the distance from the ground to the height the wearer can reach with extended arm and finger tips. The "bindings" for skis are made by local harness makers and sporting goods factories, and are of pigskin. [illegible] poles are made of ash, oak, or bamboo. Near the point a ring of wood encircles the pole, to which it is attached by leather strings; this is to keep the pole from sinking more than a few inches into the snow.



A characteristic view of the Culebra slide. This view shows the unstable muck like nature of the material.



[illegible] emergency dam. In case of gate failure this massive turntable bridge will be swung across the entrance, and gates will be lowered, cutting off the water

SOME RECENT VIEWS FROM THE PANAMA CANAL.

The First Triple-Turreted Warship

A New Italian Battleship Marks a Departure From Existing Types

By Percival A. Hislam

THE triple-turret warship is now an accomplished fact. The Italian battleship "Dante Alighieri," and the Austrian battleship "Viribus Unitis," both equipped on this system, have successfully completed their trials. In both cases it is reported that the three-gun turret gave every satisfaction as regards both the mountings and the rapidity of fire. A long-discussed question is thus definitely answered.

The distinction of being the first warship with three guns in a turret to pass into commission belongs to the Italian vessel. The "Dante Alighieri" was laid down at Castellamare on June 6th, 1909, launched on August 20th, 1910—she was the first all-big-gun ship to be launched by a Mediterranean power—and was commissioned in the middle of August. She is 520 feet long on the water line and 87⅛ feet in beam, her lines being therefore considerably finer than those of the majority of modern battleships. This is largely due to the fact that Italy is more or less combining the battleship and the battle-cruiser in her newest ships. Indeed, no distinction is officially drawn between the two principal classes of armored vessels in the Italian fleet, ships of both types—battleships and cruisers—being known collectively as "nave da battaglia."

As a result, speeds are unusually high. Italian designers have for many years past produced fast and heavily armed vessels on comparatively small displacements, but only at the expense of armor, and also, it is believed, of structural strength.

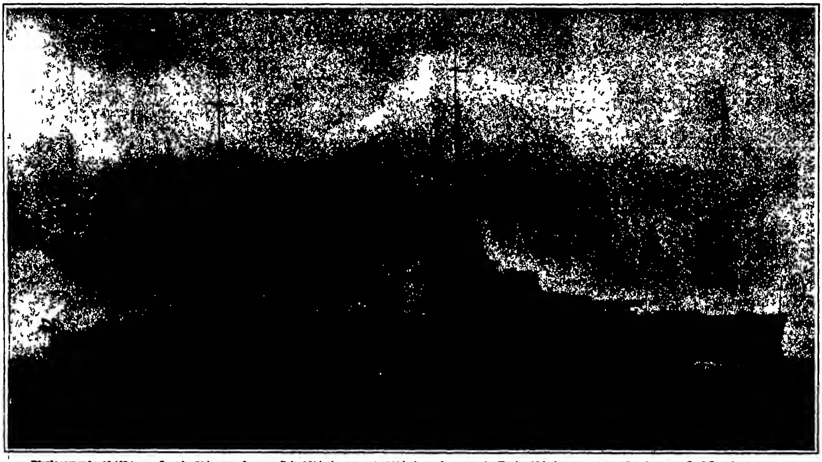
The "Dante Alighieri" has a displacement of 19,400 tons, and for her main armament she carries twelve 12-inch 46-caliber guns in four center-line turrets. The arrangement of the turrets is rather unusual in four-turreted ships, one being placed fore and one aft, and two close together amidships. The disposition may fittingly be compared with that adopted in the Austrian "Viribus Unitis," which has two superposed turrets fore and aft and with that of the Russian battleships of the "Gangut" class, in which the two interior turrets are arranged on the *echelon* principle. In the last two cases there is a full broadside and an end-on fire of six guns, while the Italian vessel, though firing twelve guns on the beam, brings only three to bear ahead and astern.

It may be recalled that the United States battleships "Nevada" and "Oklahoma" will have their big guns (14-inch) arranged on the principle of the "Viribus Unitis," save that the superposed turrets will contain two guns instead of three, giving an end-on fire of five, and a broadside fire of ten. In the "Pennsylvania" there will be three 14-inch guns in each of the four turrets.

The protection of the Italian ship shows plainly in what direction sacrifices have been made to secure high speed and a powerful armament on a small displacement. The main belt is only 9⅞ inches thick, and even this thickness is not maintained over the whole length of the citadel. The main belt is roughly terminated at the outside funnels, and the bases of the end turrets are protected by only 7 inches of armor. The barbettes, or gun-bases, are protected by only 9 inches of armor, and the hoods over the guns are half an inch thicker. Here again it is interesting to recall the case of the "Nevadas," which have a uniform belt of 13½ inches inclosing the whole of the vital parts, while the guns are protected by 13-inch bases and 16 to 18-inch turret faces. The "Dante Alighieri" has one protective deck an inch and a half thick, the American ships have two, one of 3 inches and one of 1½ to 2 inches.

The designed speed of the Italian ship was 23 knots, with turbines of 26,000 horse-power. On her trials she is reported to have made 24 knots with something in hand. Her armament against torpedo-craft comprises twenty 4.7-inch guns, twelve mounted behind 4-inch armor on the main deck and eight in small turrets abreast of the big-gun turrets at either end. Three submerged torpedo-tubes are fitted, the maximum coal capacity is 2,500 tons, and the complement is 900 officers and men.

Three other and larger Italian dreadnoughts are completing afloat—the "Conte di Cavour," "Leonardo da Vinci," and "Giulio Cesare." On a displacement of 22,340 tons these ships will carry thirteen 12-inch guns in five center-line turrets. The first, third and fifth will have three guns in each, while the second and fourth will be superposed over the first and fifth, and will contain two guns each. Two similar ships, "Duilio" and "Andrea Doria," are building, and two more, to be armed with 14-inch or 15-inch guns, will shortly be laid down. It is interesting as bearing on the differences between contemporary dreadnoughts to notice that the first four French ships of this type will have a combined broadside of forty 12-inch guns, while the first four Italian ships will total fifty-one.



Displacement: 19,400 tons. Speed: 24 knots. Armor: Belt 9½ inches turrets. 9½ inches. Armament: Twelve 12-inch guns, twenty 4.7-inch guns. Coal Supply, 2,500 tons

Italian battleship "Dante Alighieri."

Wrongly Named Substances

BLACK lead does not contain a single particle of black lead, being composed of graphite.

Brazilian grass does not come from Brazil, or even grow there, nor is it grass at all. It is manufactured from strips of palm leaf (*Chamaerops argentea*) and is imported chiefly from Cuba.

Burgundy pitch is not pitch, nor is it manufactured in, or imported from Burgundy. The best is a resinous substance prepared from common frankincense and brought from Hamburg, but by far the greater quantity is a mixture of palm oil and resin.

Cuttle bone is not bone, but a structure of pure chalk, once embodied loosely in all the substance of certain extinct species of cuttlefish. It is inclosed in a membranous sac with the body of the fish, and drops out when the sac is opened, but it has no connection whatever with the sac of the cuttlefish.

Galvanized iron is not galvanized. It is simply coated with zinc, and this is done by dipping it in a zinc bath containing muriatic acid.

German silver is not silver, but a metallic alloy, which was not even invented by a German. It has been used in China for ages.

Honey soap contains no honey, but is one part palm-oil soap and three parts yellow or crude soap, scented.

Japan lacquer contains no lac and is made from a kind of nut tree.

Meerschaum is a composition of silica, magnesia and water. The name implies petrified sea foam.

Mosaic gold has no connection with Moses or the metallic gold. It is an alloy of copper and zinc, used in the ancient musivum or tesselated work.

Mother of pearl is the inner of several sorts of shells, but not the real mother of pearl, rather being the matrix of pearl.

Pen means a feather (Latin penna). A steel pen, then, is a misnomer.

Salad oil is not oil for salad, but for dressing salades.

Whalebone does not possess any of the properties of bone, but is a substance attached to the upper jaw of the whale and serves to strain the water which the creature takes up in huge mouthfuls.

Safety-match Cough Lozenges

By John Phin

CHLORATE of potash is a favorite ingredient in "cough" lozenges, and when made up with a little sugar it forms a very palatable and effective confection. But it is not generally known that one of these lozenges if rubbed on the igniting surface of a safety match box will take fire and burn. Most of the lozenges sold by druggists, however, contain too little sugar to work well, and some are composed of pure chlorate and will not work at all. But it is easy to make a lozenge or tablet that will give startling results.

Take two ounces of chlorate of potash and one ounce of white sugar and grind them *separately* to a very fine powder. If you attempt to grind them after they are mixed, you may get into trouble. Mix the two dry powders thoroughly and moisten them with a little water or syrup so that they may be worked into a stiff dough. Sprinkle some dry and finely powdered chlorate on a smooth board, so as to prevent the dough from sticking to it, and roll the dough into a thin cake, about the thickness of an ordinary lozenge. This cake may then be cut into tablets with a knife or into round lozenges by means of a cutter. A tin tube, with the edge filed sharp, answers well. I use a gun-punch. Dry the lozenges thoroughly; this is essential and takes time, as the drying must be done at a moderate temperature; if placed in an ordinary oven, they may take fire.

One of these lozenges rubbed against the active surface of a safety match box will take fire and burn furiously, to the great surprise of those who perhaps at the very time are dissolving one of them in the mouth. But be careful not to hold the lozenge in your bare fingers when you rub it or you may get a very severe burn. It may be grasped between the folds of a piece of stiff card board, but a better plan is to take a small wooden board, 4 by 2 inches, and in it, with a center-bit, bore a hole to a depth a little more than half the thickness of the lozenge, so that when the latter is placed in the hole it will rise a little above the surface of the board, or the lozenge, while rubbed, may be held in place by four tacks or small nails driven into the board so far that they will stick up just about half the thickness of the lozenge.

Having placed the lozenge in the hole or between the tacks, rub it with the safety match igniting surface, and it will immediately burst into flame. It may be used to light a cigar, lamp or candle.

There is no danger in this experiment if ordinary care be used. I have exhibited it many times in parlors and dining rooms, and it always excites great surprise. But like all other experiments of the kind it should be well tried in some out-of-the-way place before an attempt is made to exhibit it even to a private audience.

Dry Batteries and How to Make Them

By Omega

TO construct a good working, semi dry cell, procure some pieces of ordinary sheet roofing zinc, six inches wide and seven inches long, bend them around a piece of iron gas pipe, to form a cell six inches high. Cut a circular piece of zinc so as to fit one end, and this will form the bottom of the cell, which must be fitted and soldered after the lapped joint has been soldered.

If desired the cell may be made square, in which case a block of wood planed smooth all over, with the corners slightly rounded, may be used. The block should be made 2¼ inches square, so that the sheet of zinc must be cut 6 by 9⅛ inches. This size will give about ⅝ of an inch lap. The bending will take up about ⅛ inch. When the joint has been soldered, and the bottom inserted and soldered, a brass terminal or a piece of insulated copper wire must be soldered to the top of the zinc. The length of the soldered joint and the soldered part around the bottom must be brushed over the inside with asphaltum varnish and dried.

Procure the number of carbon rods or plates that may be required, say three or four, with a brass terminal attached. These rods or plates can be obtained at almost any electrical supply store, with their tops, to which the binding screw is attached, already steeped in paraffin. The object of this paraffin treatment is to prevent the creeping of the saline solution, thus preventing the corrosion of the brass binding screw.

Prepare the following mixture: Pebble or crushed carbon and carbon dust, 3⅓ pounds; whitewood or willow sawdust, ½ pound; black oxide of manganese, 1⅓ pounds; granulated chloride of ammonium, 1⅓ pounds.

From a piece of stout blotting paper cut circular or square pieces to fit the bottom of the cells, also pieces to form linings for the inside, so as completely to cover the zinc element. Previous to inserting these make up a solution of either nitrate of mercury or bichloride of mercury, in either case one ounce of the salt to one quart of hot water. If the bichloride of mercury is used, add one ounce of chloride of ammonium (sal ammoniac). The addition of this salt will aid considerably the dissolving of the bichloride. As soon as this solution has become cold fill one of the zinc cells to the top with a portion. In the course of a few seconds the inside of the cell will become covered with a thin gray coating of mercury. Only a few seconds time is necessary for this operation. Treat all the cells alike by pouring the liquid from one cell to another, and when the operation is completed, the spare liquid may be returned to the stock solution and kept for future use. Drain each cell, then insert the blotting paper linings, pour a small quantity of the carbon manganese mixture into one cell, place on this a carbon rod, pack in more of this mixture, and press it down with a piece of wood. As soon as the cell is one third full, pour upon this a mixture of sal ammoniac, 4 ounces, dissolved in a quart of water. As soon as the liquid has become absorbed continue to fill the cell with the carbon mixture until two thirds full. Pour into this some more of the sal ammoniac solution and fill the cell with the carbon mixture until within half an inch of the top. Cut a piece of cardboard to fit the top of the cell, with a hole in the center so as to pass over the carbon rod, and soak this card board in hot paraffin previous to fitting it in place. Fit all the cells in like manner, and pour some melted pitch from a disused small saucepan, or iron ladle, upon the top of the cardboard, then pierce the pitch and cardboard with the pointed end of a metal meat skewer made red hot, or a piece of iron rod ⅛ inch in diameter, so as to form a vent. The cell may now be brushed all over with asphaltum varnish, and when this coating is dry each cell should be covered with a single wrapping of stout brown paper and a covering of the same material for the bottoms also.

The object of the sawdust is to retain and hold in suspension the saline exciting liquid, while the covering of the joints inside with asphaltum varnish prevents the mercury solution from attacking the soldered joints. The amalgamating of the zinc surface with mercury augments the electromotive force of the cell and insures a longer life. Plain zinc may be used, but it is not so effectual as when amalgamated. The black oxide of manganese acts as a depolarizer. Carbon plates or rods that have been used in exhausted dry cells can be used in making up more cells, because the quality of the carbon has not deteriorated, while being already provided with a connecting screw a little cost in making up the new cells would be saved.

Hints for Young Microscopists

By Norman Barden

WE do not look through the microscope just to see an object enlarged, but more often to see the structure of that object with its details. Sometimes it is the details of some pathological specimen, of some insect or possibly of one of the Infusoria. Each of the specimens named would require a different mode of preparation to obtain the best results, but there is a general plan of operation that is possible and it is to be described. It is true that coarse and large specimens may be placed under the microscope on the end of a needle or held with the forceps, but ordinarily there must be some degree of preparation to show the interior structure. Moist tissues of insects will have to be preserved in some preservative after they have been desiccated. The mounting media used has a great deal to do with the appearance of the specimen under the microscope. If the refracting power of the mounting media is the same as that of the specimen, the object cannot be seen at all. Hence, we must guard against using the same media for mounting everything, as we shall see later.

Generally speaking, there are two methods of preparing objects for microscopic investigation: 1. Mechanically, by picking and teasing for the separation of cells and isolation of elementary parts. 2. Chemically, by the use of reagents to dissolve fats, loosen connective tissue, and to act differently on different elements.

There is a host of instruments manufactured for dissecting, but by practice the same can be accomplished with a few simple instruments. This does not apply to the cutting of sections, which, as everyone knows, is done best with the microtome. However, about four scalpels, two forceps, one sharp pointed and the other blunt, and a pair of small scissors are to be included in every complete set of microscopic accessories. The dissecting needles are the most serviceable of all the instruments and can be made by mounting long fine needles in wooden handles. Some are to be left sharp pointed while others should be given a cutting edge of about an eighth of an inch. Among the other instruments for dissecting there should be a glass pan or tray about four by five inches, a good strong magnifying glass and a stand for holding it and the glass tray. A convenient way of arranging the apparatus is shown in Fig. 1.

To prepare the specimen by teasing, place a very small piece of it in water and pick it to pieces with the sharp pointed needles. This is easily accomplished if the specimen has been macerated for a few days in some chemical such as potassium hydroxide to dissolve the fats and loosen the connective tissues. The teasing must be performed slowly and accurately. Beginners fail a great many times because they give up too soon or they sit in a strained position which causes them to become nervous and consequently their arms

(Concluded on page 441)

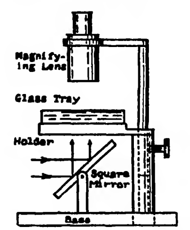


Fig. 1.—Arrangement of the dissecting apparatus.

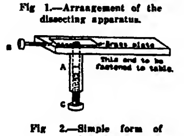


Fig. 2.—Simple form of microtome.

Plate 1.—Implantation of hair.

Plate 2.—Section of tongue.

Plate 3.—Bare papillae of the tongue.

Plate 4.—Section of a vine stem.

Plate 5.—Maxillary palpi of tongue of house fly

A Coal Engine

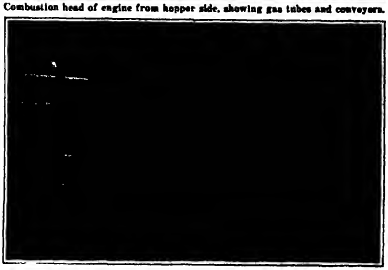
By the Paris Correspondent of the Scientific American

THE internal combustion engine invented by Mr. Archibald Low, a prominent English engineer, is attracting much attention among engineers owing to its novel method of working. In fact, it is operated by a direct feed of coal so as to contain the gas-producer in very compact shape directly within the engine itself and without increasing the size of the engine appreciably. The inventor has been working for a number of years upon the subject, and now brings out a practical running engine of 80 to 100 horse-power size, such as our engravings show. He first started with a small 2 horse-power engine in order to prove the principle of the direct coal feed, and after this had been run with good success he started building the large engine which is now running in London.

Our diagram illustrates the principal details of the engine, and it works in the following way. Tubes with worm conveyors running in them are used to take up the coal in size depending on the dimensions of the engine and to pass it along within the engine in order to subject the coal to heat within the tubes. In this way the set of tubes act as a gas-producer, and the gas then goes to the engine cylinder to be used on the internal combustion principle. On its way through the tubes the coal is first heated by the exhaust gases of the engine passing around the outside of the tubes, and this heat serves to drive off most of the coal gas, at least, where bituminous coal is used. The carbon and the tarry products then pass along the tube until they reach the part which runs through the combustion chamber of the engine cylinder where the combustion is taking place, and here they are still further heated and reach a high temperature. Steam and air are then injected through the tubes and upon the hot coal, and when this impinges on the heated carbon it produces water gas as well as air gas. Referring to the diagram, the coal is fed in through the hopper *A*, and the conveyors *CC* draw it along through the set of tubes, the worms being driven by suitable gears. The coal is first heated where the tubes pass through the chamber *E*, as here the exhaust gases of the engine play around the tubes. When in the combustion chamber of the engine *F* the heating effect keeps up and the temperature is still higher. The gases from the coal are given off from the tubes by small openings which allow them to pass out into the collecting chamber *D*, and from here they pass to the inlet of the engine for use on the gas engine principle. In order to produce the combustible gas in the proper way air and steam are admitted to the chamber *G* which also serves as the ash box so that the suction strokes of the engine cause the air and steam to be drawn over the hot carbon, and this produces air gas and water gas. When using bituminous coal, which is a very good fuel for this work, the coal gas which the coal gives off in the first place as we mentioned above, is added to the other gases, so that as soon as the coal gas is formed and the gas cock opened a mixture of coal gas, water gas and air gas is drawn into the engine cylinder along with the needed supply of extra air. This forms the explosive mixture for the engine and it is ignited and used on the ordinary internal combustion method. The present single cylinder is 16 inches by 25 inches. The engine is noticeable for its small size and compact build, and it is self-contained in spite of the fact that it produces its own gas from coal. Thus the new engine appears to be a remarkable one in many respects. The construction of the engine does not need any special care. Starting up is done in ten minutes with the first engine, and this time will no doubt be reduced. In starting, the engine is simply run on coal gas from the mains or by oil, and the change-over to the usual working is done by using a two-way cock at the proper time. No excessive wear is noticed upon the coal tubes, which is another good point. Of oil engines in this connection, especially the Diesel engine, the inventor remarks that however good the oil engine may be in itself, we should be sure that in the future extension in this field there will be a sufficient supply of oil fuel to be had. This point appears to have been overlooked, at least as far as England is concerned. Should the steam engine be put out of the field by its growing competitor, the oil engine, this becomes a leading question, and it is well known that the amount of oil in England produced from shale is comparatively small. In fact, the Admiralty admits that should the navy use oil exclusively for engines, the demand would be greater than the supply, and this regardless of expense at least as far as government work is concerned. Should liquid fuel be used for only one thousandth part of the power production in that country, the home supplies would fall far short of what is needed. Without referring to importations of oil, and in time of war this might become impossible, it will be seen at any rate that the question is an important one for England as well as for many other countries. On the contrary, the new engine, should it become widely used, would employ coal which is so abundantly produced in that region. It is to be remarked that the engine is very economical to run, as the inventor states that it consumes only half a pound of coal per B. H. P. hour. The engine runs well even on slack which costs $1.25 a ton, which means that as to fuel it is about twelve times cheaper than oil.

The striking efficiency of the new engine is mainly due to the fact that it uses waste heat. Large gas engines are at a disadvantage, as the heat of the explosion cannot be absorbed as it should be by the piston which moves at a relatively slow rate. But in the new method the heat is utilized by increasing the surface of the combustion chamber, that is by inserting the producer tubes. Hardly any other change is needed beyond adding the compact parts for the gas production, so that the engine has much the usual appearance. The present engine runs at the standard rate of 140 revolutions per minute, and is found to give very satisfactory results as to the quality of the explosion being of very easy running, and even more as used on coal gas. At the start, when changing over from coal gas to the normal run, the engine appears to run easier when using its own produced gas, owing no doubt to the quality of the mixture of gases which is employed. The engine can be run at a high temperature without fear of preignition, and the water in the jacket could even be boiled and the steam used without any damage. Space is saved by the absence of a producer and the engine need be no larger on this account, so that it appears to be well adapted for marine work.

Combustion head of engine from hopper side, showing gas tubes and conveyers.



A new internal combustion engine of 80 to 100 horse-power now in operation.

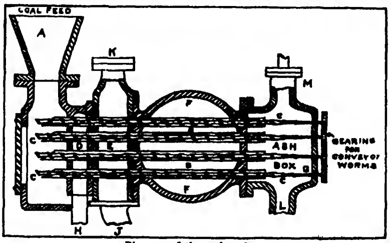
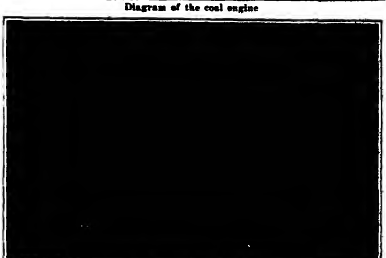


Diagram of the coal engine



Low engine (with inventor). The engine is seen from the ash [illegible] side.

Convention of the International Union for the Protection of Industrial Property

THE convention of the International Union for the Protection of Industrial Property, which was [illegible]

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

TIE HOLDER.—G. W. WILLIAMS, 196 De Kalb Ave., Brooklyn, N. Y. This tie holder is adapted to be firmly held in position upon the inside of a collar, to hold a tie in place. The invention affords a free riding surface for a sliding tie in the wide portion between the standing and the turn-down element of a collar. The invention permits the tie to be readily drawn about in the wide portion between the elements of the collar, but at the same time will keep the tie away from the lower outer edge.

Electrical Devices.

TELEPHONE ATTACHMENT.—A. SCHLOSSMAN, Dodge, Neb. This invention relates to improvements in telephone attachments, and has particular reference to devices of this character devised for the purpose of detecting in a very simple and highly effective manner the interference with party lines due to unauthorized parties listening to a conversation.

ANNUNCIATOR SYSTEM.—H. CALDWELL, 501 Federal Bldg., Chicago, Ill. The more particular purpose here is to provide an electrically operated annunciator having a movable drum provided with characters which may be seen from a distance, the drum being so arranged that it may be quickly turned to any desired extent at the will of a distant operator.

Of Interest to Farmers.

BALE TIE.—B. A. FRANTS, Weatherford, Tex. Address Frants Standard Buckle Co., Weatherford, Tex. This buckle is for use in securing the ends of a bale tie such as used on cotton bales and the like, and the present invention relates to a construction including a swinging latch for closing the open end of the buckle. Mr. Frants has invented another bale tie, the object of the improvement being to obviate in a simple and practical manner several former objectionable features by constructing the hook in such manner as to insure a positive engagement therewith of the side member when strain comes upon the band, and thereby produce an efficient and advantageous form of tie.

PLANT CANE SHAVER AND GRASS SCRAPER.—T. LABORS, Labidieville, La. The intention here is to provide a mechanism having adjustable cutting devices and an adjustable deflecting device, the said devices being supported yieldingly by the main frame and capable of adjustment on the said main frame.

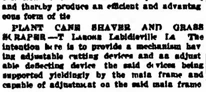
Of General Interest.

SEPTIC TANK.—H. B. PAYNE and S. MOORE, 823 Pine St., Texarkana, Tex. This invention refers to septic systems of sewage disposal, the aim being to provide improvements in the construction of the tank itself whereby the system as a whole may be readily and quickly installed and its capacity either before or after installation readily adjusted to suit existing conditions.

WAX EXTRACTING APPARATUS.—W. S. WATSON, Lock Box No. 1, Butler, Pa. The device is particularly applicable to extraction of wax from the candelilla plant. An object of the invention is to provide a device in which the process of extraction may be carried on continuously, the shrubs being placed in at one end and being taken out from the other while the wax is taken out at a different place.

CLAMP.—J. L. BAYERLEIN, A. C. SUDDARTH and H. B. WOOD, Monterey, Va. Address A. C. Suddarth, Monterey, Va. The invention has for its object the provision of a device especially adapted for use in supporting woven wire fences, wherein means is provided for clamping the entire width of the fence with a uniform pressure.

COMBINED MATCH BOX AND BURNT MATCH RECEPTACLE.—A. C. HALL, 603 N. 31st St., Richmond, Va. Mr. Hall has devised a pocket receptacle for burnt matches which forms an attachment of a match box proper. The receptacle is arranged directly



MATCH BOX AND BURNT MATCH RECEPTACLE

under the match box and provided with a metal fastening which engages the hollow body of the match-box and is fastened detachably at its free end by means of a spring catch. In other words, the latch fastening or latch detachably connects the match box and receptacle and allows easy application and detachment of the former, and at the same time serves as a part of the fastening for the latter.

TETRODOTOXIN AND PROCESS OF EXTRACTING THE SAME.—Y. TAHARA, Tokyo, Japan, care of Takamine & Shiels, 366 W. 120th St., New York, N. Y. The invention refers to chemical processes of extracting tetrodotoxin, the toxin of Tetrodon (Jap. "Fugu"), and refining thereof to its pure state after removing both organic and inorganic matters, together with various other impurities from the viscera of Tetrodon and the products obtained by the processes.

FOUNTAIN COMB.—E. H. DARCY, Holly Springs, Miss. This invention provides a comb for dyeing the hair or removing dandruff from the same, in which the container is removable from the comb and can be easily cleaned and in which the flow of liquid is controlled by pressure applied to the container, the liquid being distributed evenly to the surface of the teeth of the comb.

BOAT RELEASING DEVICE.—J. Y. PORTER, JR., Key West, Fla. The object in this case is to provide a device inexpensive to manufacture, and provided with a body which may be readily attached to the bow or stern of a life-boat without altering the construction of the life-boat or the arrangement of the air tanks thereon.

PORTABLE DITCH DAM.—A. CADWALLADER, Cliff, Neb. This invention is an improvement in portable ditch dams and has for its object the provision of a simple inexpensive easily operated dam for use especially in irrigating ditches for taking a specified amount of water from the ditch regardless of the amount of water passing through the ditch.

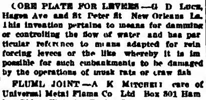
COMBINED SASH HOLDER AND SHADE SUPPORT.—J. NELSON, 400 Hemphill St., Hattiesburg, Miss. This invention provides sash holding means including elements adapted to be secured to the upper sash of a window and to move therewith and elements attachable to parts of the window other than the upper sash and relatively to which the elements carried on the upper sash are movable whereby the upper sash may be lowered to any extent and sustained in lowered position.

CORE PLATE FOR LEVEES.—G. D. LOCK, Hagan Ave. and St. Peter St., New Orleans, La. This invention pertains to means for damming or controlling the flow of water and has particular reference to means adapted for reinforcing levees or the like whereby it is impossible for such embankments to be damaged by the operations of musk rats or craw fish.

FLUME JOINT.—A. K. MITCHELL, care of Universal Metal Flume Co., Ltd., Box 801 Hamley Bldg., Victoria, B. C., Canada. The present invention is more particularly designed as a development of invention forming the subject matter of an application for patent on flumes, filed by Mr. Mitchell (Serial No. 708,573), in which flume the overlapped ends of the flume sections are plain and without any bends or interlocking engagement, the sections being held solely by compression of the straps.

Hardware and Tools.

LAWN SPRINKLER.—B. F. CATHCART, 702 K St., Fresno, Cal. This sprinkler is so attached to the service pipe and to the box or housing that the water pressure will raise the sprinkler automatically, there being a novel form of closure comprising two vertically rock-



LAWN SPRINKLER.

ing cover sections which are engaged by the sprinkler head or nozzle in its upward movement to open the closure, the arrangement being such that upon the withdrawal of the pressure and the consequent dropping of the nozzle or sprinkler, the cover sections will be automatically closed.

KETTLE TILTER.—J. RIEMER, JR., Kellogg, Minn. In this case the object is to produce a device so constructed that by the use thereof an ordinary kettle or other vessel having a lid may be readily and easily tilted and the contents discharged with but one hand and without danger of ever dropping or scalding in case the contents of the vessel to be drained are in a heated condition.

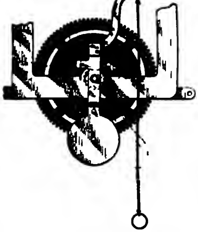
Heating and Lighting.

BOILER.—F. BUSCONDO, Contreras 28, Matanzas, Cuba. This boiler is more especially designed for use on locomotives and is arranged to provide a large heating surface to insure a rapid circulation of the water, and quick generation of steam, to avoid exposure of rivets to the heat of fuel in the fire-box and thus reduce leakage to a minimum, to permit easy cleaning of the boiler, and to avoid incrustation.

OIL BURNER.—C. F. POWERS, 517 N. 19th St., Birmingham, Ala. This device burns kerosene, gasoline or denatured alcohol with equal facility. The burner is simple in construction and provided with a heat retaining portion and a thinner heat conducting portion which may be readily heated to bring the fluid fuel to the vaporizing temperature.

Machines and Mechanical Devices.

CLOCK WINDING DEVICE.—C. T. BERNHARDT, Box 544, Salisbury, N. C. An object of this invention is to provide a clock winding device in the form of a self contained unit attachable to the spindle of the winding barrel of the clock, and bodily removable there-



CLOCK WINDING DEVICE

from when desired. By the special arrangement of a pawl the attachment is adapted for employment either with a clock mechanism in which the spindle turns backward as the clock unwinds or for one mechanism in which the spindle remains stationary while the clock unwinds. The illustration shows a front elevation of a winding device illustrating the same in connection with portions of a clock including the spindle of the winding barrel.

SCALE ALARM.—W. T. RICE, Corpus Christi, Tex. The invention provides a simple inexpensive easily applied and automatic device operated by the placing of the article to be weighed on the scales for indicating to the operator that the scales do not balance or that it is out of plumb.

HEEL SWEEP SETTER.—W. I. WILSON, P. O. Box 210, Stephens, Ark. This invention is an improvement in heel sweep setters and provides a simple easily operated device of the character specified wherein mechanism is provided for receiving and holding a heated heel sweep and for shaping the sweep while held by the support.

KNITTING MACHINE ATTACHMENT.—N. D. BUCK, 169 Irving Ave., Brooklyn, N. Y. The present invention relates to a new and improved attachment for knitting machines of a type adapted to knit sweaters whereby the speed thereof may be varied to allow for different conditions such as plain or half cardigan and racking stitches.

PAPER GAGE FOR TYPEWRITERS.—S. F. CAMPBELL, 304 W. 11th St., Grand Island, Neb. This invention has reference to attachments for typewriting machines and has particular reference to an attachment constituting indicating means whereby the operator may determine at a glance the position of the paper. The introduction of paper into the machine in a straight condition is facilitated.

LUG STRAP FOR PICKER STICKS.—W. N. KELLEY, 1850 Perkiomen Ave., Reading, Pa. The invention relates to looms and provides picker sticks arranged to insure a proper transmission of the power applied to the picker stick, to prevent accidental shifting of the lug strap of the picker stick and to avoid weakening of the picker stick by holes, notches or the like.

ADJUSTABLE BEARING.—G. E. HASELTON, R. F. D. 4, Plattsburg, N. Y. The intention here is to provide a bearing for an anti-racing device arranged to prevent racing when shifting from a heavy load to a light one or vice versa. For this purpose use is made of a base provided with a pin on which is mounted to slide a forked bearing by the use of a sleeve nut turned on the base and screwing on the forked bearing.

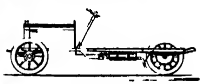
Pertaining to Recreation.

AMUSEMENT DEVICE.—R. F. MAYNES, 80 Atlantic St., Jersey City, N. J. For the purpose of providing a highly exhilarating and rather unsuspected ride use is here made of a slide and a starting chamber at the head of the slide, the chamber having a collapsible support for a person to occupy and means for collapsing the said seat in the direction of the slide to cause the person occupying the seat to slide down off the support and down the slide.

Pertaining to Vehicles.

TRACTION ENGINE.—H. I. CAMPBELL and B. K. POSTLETHWAITE, care of the latter, 601 Oneida Block, Minneapolis, Minn. This invention provides an engine having a plurality of carrying wheels and a belt like band for increasing the ground surface contact, provides an engine with means for augmenting the traction pull of the driving wheels and with hauling devices and provides a frame and supporting wheels therefor arranged to flexibly accommodate the wheels of the road load and to dispose the hauling strain directly upon the axles of the traction wheels.

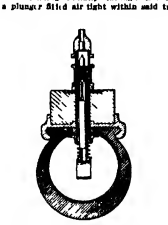
PNEUMATIC ANTISKID DEVICE FOR POWER DRIVEN VEHICLES.—B. DE LOLASS, Ja. of Llewellyn Park, N. J. has invented and perfected an apparatus whereby a car can be instantly prevented from skidding without the aid of antiskid chains or similar devices. By pressure on a foot lever he makes the exhaust



PNEUMATIC ANTISKID DEVICE FOR LOWER DRIVEN VEHICLES

gases from the engine spread a sheet of sand in front and on either side of the drive wheels so that the tires will be prevented from slipping sidewise or skidding. At the same time the gases are substantially muffled and silenced so that their is no objectionable noise as by the wing cut the muffler. The roadway can be sand I exactly when and where needed. The apparatus is located in an inconspicuous portion of the frame and does not take up valuable storage space.

AUTOMOBILE TIRE AND TIRE SIGNAL.—J. F. FEATHERST, Valley City, N. D. This invention is a rim carrying a tire and having a tube extending radially through the rim and a plunger fitted air tight within said tube



AUTOMOBILE TIRE AND TIRE SIGNAL

and carrying a valve for admitting air in the tire, the plunger being movable relatively to the rim under the influence of the wheel when the tire is deflated and uncontrollable by deflation of the tire for the purpose of actuating the signal.

Designs.

DESIGN FOR A SHAVING MUG.—H. ASHTON, Rhinelander, Wis. In this design for an ornamental and useful cup an article is gracefully designed and shows means for shielding the lips, moustache, etc., from the contents of the bowl.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention and date of this paper.

The Industrial Need of Technically Trained Men—III

Opportunities That Await the Trained Engineer

By A. J Himes, President of the Cleveland Engineering Society

[*THIS is the third of a series of monthly articles on the professional opportunities that await the technically trained engineer, physicist, chemist, bacteriologist and technologist in modern life The author of this article is peculiarly competent to speak on the subject Since graduating from Cornell University as a civil engineer in 1887 he has had a wide experience in his profession He is engineer of grade elimination of the N Y C and St L R R Previously he was assistant chief engineer and before that bridge engineer of the Nickel Plate He has been consulted on appraising the Michigan railways and estimating for water supply for New York city He was assistant engineer to the United States Board of Engineers on deep waterways and has served as resident engineer for the eastern division of the New York State canal He was recently chairman of a sub-committee of the Cleveland Engineering Society on technical education in Cleveland, and made a report on technical education in the schools of Cleveland which has attracted considerable attention* —EDITOR.]

An engineer should be a leader of men He occupies of necessity a commanding position among his co workers and without a goodly supply of the qualities of leadership the highest success will not be reached The times are rife with rebellious thought and one who listens may come to think the exercise of authority a crowning sin Children are not trained in obedience either at home or in school and among adults the breaking of a rule or the evasion of a law is a gleeful adventure Such conditions are born of ignorance and malice It is impossible to erect a great steel building without the most perfect discipline among the workmen No great effort involving the co-operation of a multitude of men can be successful without a clocklike organization and the faithful observance of orders by its every unit But organization and discipline are not synonyms of despotism and history shows that the greatest leaders have been both loved and revered by their men It is needless to say that a small minded man of selfish aims and meanness of spirit would fail to qualify in this important particular for the life of an engineer

In recent years the greatly increased popularity of technical and scientific education has produced such an influx to the ranks of the profession that talk of over crowding is frequently heard The profession has proved so attractive that persons whose motives seem purely mercenary have sought to stimulate the education of engineers

But talk of overcrowding brings to mind the fierce labor riots along the Erie Canal during the early development of railroads Graphic accounts of these disturbances are filed among the Assembly documents at Albany Their origin was founded in the belief that the development of railroads would destroy the business of building canals and that there would be no work for the laboring men Looking backward over the years of phenomenal railroad development and remembering the difficulty that has been experienced many times in securing a sufficient supply of labor and that in spite of the rapid increase in population one can hardly believe in the sanity of the advocates of such ideas

The case of the engineering profession to-day is in a measure parallel to that of the canal builders Having attained the summit of engineering achievement in the building of the Panama Canal the pessimists whose peculiarities were so vividly described thousands of years ago in the book of Ecclesiastes, see only retrogression and decline But engineering art is too young too virile for such a fate We have problems to solve which will cause the Panama Canal to occupy a much smaller portion of our field of vision than it does to-day The regulation and control of the Mississippi River is such a problem Our irrigation problems, the Salton Sea the Grand Canyon of the Colorado River afford opportunities for engineering works of the highest order The improvement of transportation lines through cities, streams and mountains will call forth our utmost energy and skill. Water supplies and the sanitation of cities are of immediate necessity and it will be many many years before our highways can attain a development comparable to those of the ancient Romans.

There are fashions in engineering as in spring hats The popular mind does not seem capable of thinking calmly of more than one style at a time and suiting them to its needs. Just now reinforced concrete holds the stage Stone masonry is a thing of the past. At one time canals were popular Then came the railroads Now better highways are much desired and canals are again looming in the distance Locally there is difficulty in assigning proper relative importance to sewerage and water supply

But of lack of engineering problems there is none It is not a case of lack of work but how much work we can do How soon will we be strong enough and skillful enough to undertake hopefully other and larger problems that will add still more to the delightfulness of the beautiful land in which we live

He is a fortunate engineer whose early training and education has been planned with an eye to his future profession Much of the fitness which a man may have for the work of his life is the result of early environment and training a conspicuous fact in the lives of engineers It has been commonly remarked that young men from the country display a superior aptitude for surveying This is to be expected The country boy has many opportunities to acquire a self reliance and resourcefulness in his peculiar environment that are useful on extensive surveys He learns to wield an ax or a saw to outwit an angry bull or a vicious dog to build a fire and to find his way through dense woods in the dark

In the city this development is supplied to a degree and in some respects excelled by the training of the technical schools It is essential that an engineer should be intimately familiar with the properties of structural material and this knowledge he can gain in schools. He handles the iron at the forge and at the lathe and pours it molten from the furnace to the molds which he has made He cuts the wood and fashions it into forms of which he has first made careful drawings He does these things because of the pleasure he feels in building with his own hands, but at a later date when called upon to construct great works he uses the materials wisely because he knows them as friends. He knows their properties and capabilities and putting them together each in its proper place, there is produced a thing of strength and usefulness.

The studies which are peculiarly designed for the development of an engineer are mathematics and science Of course there are others but of these the nature is such that they are rarely pursued except at school, while descriptive texts can be read at any time No boy who is to become an engineer can absorb too much algebra, geometry and physics unless it be to the exclusion of other knowledge.

There are varied lines of engineering work In some, there is much to be done with a modicum of mathematics, in others there is need for much learning. So if there be much learning it will not lack a useful field, and if the learning be scanty there may still be a field of small dimensions and small reward

There is competition among the colleges to see which one can publish the longest list of studies. It makes the poor boys dizzy and serves to [illegible]. A few [illegible] carefully [illegible]

oughly taught will do far more to develop a useful mind than the most elaborate curriculum hastily skimmed in the time allotted for a college course. It might prick the pride of a college president to know that his own institution had failed to cover the whole realm of human thought, but when more attention is given to the development of men and less thought to the making of encyclopedias, the beneficial effect will be quickly apparent. Surveying hydraulics and applied mechanics are essential for an engineer Geometry and drawing are taught in the high schools, but their study should be continued at college Trigonometry must be learned from A to Z. It is the basis of a great variety of computations. If these subjects have been studied thoroughly under good teachers, the foundation for an engineering education has been laid. A completed education does not exist A professional man must study always. In college his greatest need is to learn to study to grow familiar with books and their use

While the subjects already named are most directly useful in engineering the benefits of a more general education must not be overlooked. Engineering is a learned profession, and its members must of necessity be well versed in a great variety of knowledge In general and specifically he is charged with the practical application of natural science. Beyond that his relations with other men are such that a knowledge of logic and law are very helpful He should be a good accountant and be familiar with the use of indexes and files

There has been much discussion about the possibility of becoming an engineer without a college education Some men have done so A remarkable athlete can win a contest with a handicap but most of us are glad to win with all the advantages possible No better answer can be given

Convention of the International Union for the Protection of Industrial Property

(Concluded from page 436.)

tion on June 2nd, 1911 has been ratified by the following governments Austria Hungary, Germany Dominican Republic, Spain United States France Great Britain Italy Japan Mexico Norway Netherlands Portugal Switzerland, and Tunis.

It will be recalled that Article 18 of the convention provides that the ratifications of the adhering countries shall be deposited with the Department of State at Washington not later than April 1st, 1913 and that the convention shall be put into execution among the ratifying countries one month thereafter The act with the final protocol replaces in the relations of the countries which have ratified it the convention of Paris March 20th 1883 the final protocol annexed to that act the protocol of Madrid April 15th 1891 relating to the dotation of the International Bureau and the additional act of Brussels December 14th, 1900 The acts cited shall remain binding on the countries which have not ratified the Washington convention of 1911

The ratifications of the countries mentioned having been now deposited in the Department of State, there are still remaining five governments adherent to the prior conventions which have not yet ratified the Washington convention. These countries are Belgium Brazil, Cuba Denmark, Sweden

It is officially declared that the ratification for Austria Hungary is effective with respect to Bosnia and Herzegovina and the ratification of Great Britain relates only to the United Kingdom of Great Britain and Ireland.

At the conference of Washington twenty nations other than those already mentioned were invited to participate in the deliberations with a view to becoming adherents to the Paris treaty of 1883 and its subsequent amendments. Up to the present time none of these [illegible]

for the Protection of Industrial Property. There is evidence however, of an increasing interest on the part of non adhering countries in the protection of industrial property and by the time the next conference is held it is expected that the union will be increased by further adherences. The next conference will be held at the Hague, the invitation from Queen Wilhelmina of the Netherlands having been announced at the Washington conference by her representative M. Snyder Van Wissenkerke, and unanimously accepted by the conference at its final session. The date for the next conference however has not yet been decided upon. Invitations thereto will be sent out from the bureau at Berne as has been the case for former meetings.

Hints for Young Microscopists

(Concluded from page 434)

shake so that they spoil the specimen. To make sections of epidermis and other large specimens requires that the specimen be hardened or imbedded in paraffin. To harden tissues place them in absolute alcohol until they have acquired the proper degree of hardness or soak them for a few days in a two per cent solution of bichromate of potassium. For imbedding in wax the specimen should be hardened in alcohol and then surrounded with the wax mixed with a trifle of oil.

A sharp knife or best, a razor blade should be used for cutting the sections. With a little practice one can cut good sections with a razor blade provided that they are cut under water. The simplest form of a microtome is shown in Fig. 2. *A* is a hollow cylinder threaded at the lower end with a very fine thread. *C* is the adjustment screw for varying the thickness of the sections being cut. It is threaded to fit the cylinder and when turned pushes up the plunger which in turn moves the specimen. *B* is a set screw for making fast the specimen. The specimen to be cut is either placed in the tube *A* loose and made firm with the set screw or it should be surrounded with wax by pouring the wax into the cylinder while the specimen is held in place. Plant stems can be cut in an excellent manner by the use of this simple microtome.

Bones, teeth, shells and all other hard substances require to be ground so thin that they can be examined by transmitted light before they are in a condition to be examined microscopically. With a fine-toothed saw as thin a section as possible is sawed off of the specimen. This section is now ground smooth on one side by rubbing it over a fine file or a piece of flat grindstone. After this has been done the section is given a finer finish by grinding it with washed emery. As a finishing polish it is polished with rouge. Now after the one side has been finished, this side will have to be cemented to a glass slide to permit the other side to be finished. For cementing it will be convenient to use Canada balsam. The section must be washed free from all grinding materials and must be thoroughly dry. So too the glass slide must be clean and dry. A drop of the balsam is put on the center of the slide and warmed until it runs and upon hardening becomes very thick. The section is now pressed firmly upon the balsam and the whole heated until the balsam becomes liquid again. Under no conditions must the balsam be boiled. Another glass section is placed on the section and clamped so that the bone is held tightly to the slide. It is then set away in a warm place for a few days to let the balsam become hard. The other side of the section is then ground in the same manner as was the first side and a cover glass is cemented on with balsam. The one thing to be careful of, is not to grind the section too thin. It should be frequently examined under the microscope, and as soon as a good section is obtained, the grinding should stop.

Most tissues are made to show their structure better by staining. The section is placed in the stain and left there a few seconds, or even minutes until the stain has penetrated all through it. It is then

washed in distilled or sterilized filtered water to remove the excess of stain. If the section is to be mounted in an aqueous medium the stain must be fixed so that it will not run For Canada balsam mountings most stains will not require fixing When staining infusoria and rotatoria and other animalcules the stain is put on the specimen by means of a dropper and left on for only a few seconds. If then the specimen is stained too deeply it can be decolorized by immersing in alcohol All animalcule preparations should be passed through the Bunsen flame five times before staining This is to set the animalcules to the glass. The stains for staining vegetable tissue should contain from fifty to seventy five per cent alcohol The stains for animal tissues can be made like those for vegetable but for pathological specimens where bacteria are looked for the stains should be concentrated and double staining is required The method of double staining will be described later To mount the section it is placed in a drop of balsam xylol (xylol and balsam q v) which has been previously placed upon the center of the slide. It may be left to advantage in this condition for a day so that the balsam will have time to penetrate the air spaces The slide however must be placed in a dust proof place After the balsam has penetrated all the section the slide is warmed until the balsam spreads freely and a cover glass is also gently warmed The cover glass is now lowered upon the section care being taken to see that there are no air bubbles caught under it A spring clip is now put on the mounting to hold the cover glass tightly against the slide and specimen A few formulæ for stains that are generally used for nearly all kinds of specimens are given below so that the student may compound his own stains

1—Red Stain

(a)	Carmine	1 part
	Ammonium hydroxide	1 part
	Distilled water	8 parts
(b)	Oxalic acid	1 part
	Distilled water	22 parts

To use Take 1 part of carmine solution to 8 parts of acid solution and add 12 parts of alcohol Filter After staining wash in 7 per cent solution of alcohol

2—A red one-solution stain can be made by saturating ½ ounce of alcohol with carmine

3—Lilac color

Borax	4 parts
Distilled water	56 parts
Dissolve and add carmine	1 part

Mix with twice the volume of absolute alcohol and filter

4—Violet stain

Alcohol	1 part
Distilled water	1 part

Saturate with methyl violet and filter

5—Acid carmine stain

Mix ammoniacal solution of carmine with acetic acid in excess and filter This is said to stain diffusely If glycerine with muriatic acid (glyc 200 and acid 1) is added it concentrates all the color in the cell nucleus

6.—For vegetable tissues.

(a)	Haematoxylin	40 grains
	Absolute alcohol	½ ounce
(b)	A solution of 4 grains of alum in 2 ounces of water	

To use Add a few drops of a to a little of b

Fresh membranes if soaked in a solution of nitrate of silver (0.5 per cent to 1 per cent sol) and washed then exposed to the light, may show the mosaic epithelium

Double staining is most used where the specimen contains bacteria If such is the case the following method has proved to be a reliable one With a solution of gentian violet, the whole film on the cover-glass is first stained violet. Now by immersing the cover glass in a solution of iodine in iodide of potassium (iodine, 1 part, potassium iodide, 2 parts; water, 80 parts) the stain is fixed in the bacilli and not in the cells. The cover-glass is then washed and stained with a contrast stain.

Fix the bacteria with the [illegible]

there is a large field of objects that will be found interesting For the infusoria a wide mouthed bottle will be found quite sufficient A conical net of muslin or linen will be needed for securing other animalcules that swim about in the different strata of water To collect the infusoria get some of the small weeds that grow on the bottom of a small ditch or pond No doubt there will be some of the tree like colonies of the vorticella fastened to the weeds You may also find other specimens of the rotifera and other polyzoa The vorticella are to be looked for on the small green branches of the weeds and sometimes can be recognized with the naked eye A collection of this sort can be kept in a small aquarium for several days For securing the free swimming animalcules the net is swept through the water and then drained Now it is carefully turned inside out and the bottom gently rinsed in a wide mouthed bottle half filled with water Also a bottle may be lowered inverted into the water and at the right depth turned upright This method of obtaining the animalcules will give a great variety of specimens of all sizes including some kinds of bacteria So we see that a small pond or ditch will afford nearly all the objects that are of interest to the beginner As for getting plant stems and vegetable epidermis the summer garden will have a good variety Nearly all of the plants and vines that have ribbed stalks exhibit a beautiful cell structure Flies and insects are easily caught with a bag net and should be soaked for a few days in a five to ten per cent solution of potassium hydroxide before examining Some vinegar contains minute worms which can be easily mounted For the beginner the collection and preparation of objects will be found to be very interesting and will no doubt lead to the culturing of other micro organisms that are not found in stagnant water

Description of Plates

Plate 1—Implantation of hair in skin Double staining Balsam mounting × 50

Plate 2—Section of the tongue Methyl violet staining Balsam mounting × 25

Plate 3—Section of the tongue showing the fire papillae Fuchsine staining × 80

Plate 4—Section of vine stem showing the annular cell structure Glycerine media × 25

Plate 5—Maxillary palpi of the tongue of the house fly Balsam mounting after treatment with potassium hydroxide × 40

Engineering in the Alps

WORK is going on at present upon a tunnel through the mountains between France and Switzerland in order to give a more direct railroad connection What is remarkable in this case is that unusually large quantities of water were met with and the piping which had been laid in the tunnel was not sufficient to take care of the great outflow from the underground springs so that the tunnel was flooded up to two feet height and quite a large cascade flowed out at the entrance This also caused the neighboring springs to fail more or less The somewhat curious result follows that an output of 100 to 250 gallons per second will be taken away from the basin of the Rhone or the French region and is now to be added to the Rhine basin in the Swiss region and thence to German territory Owing to this unforeseen event the expense of the work will be increased to a great extent and the cost of the tunnel reckoned at first at $3 500 000, will now be at least tripled It is stated that but little previous work was done in the way of geological surveying and this is now regretted In fact, the accident occurred exactly at the point predicted by M Fournier, professor of geology at the Besançon university, according to his examination of the geological conditions of the

SIXTY NINTH YEAR

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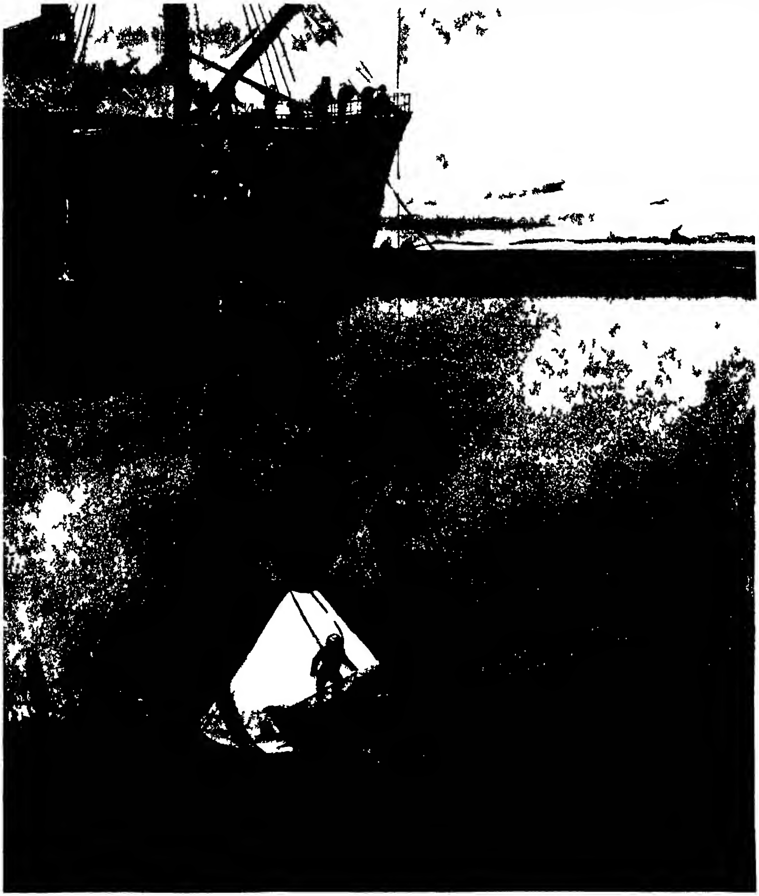

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement.

Rothamsted Up to Date

THE sixty years' work of Lawes and Gilbert made the name of Rothamsted familiar to agriculturists the world over, and to-day there is hardly a book on agriculture in which the results attained on that famous experimental farm are not more or less frequently mentioned. Since the death of Lawes in 1900 and that of Gilbert in 1901, the work has gone on without interruption and in fact has greatly expanded, thanks to increased funds, including a grant from the British government. The history of the enterprise is traced in the last annual report of the director.

John Bennet Lawes came into possession of the Rothamsted estate in 1834 and at that time began experiments with various manurial substances, first with plants in pots and then in the field. In 1843 he obtained the services of Joseph Henry Gilbert as director, and began more systematic field experiments.

The Rothamsted Experimental Station has always been independent of any other institution, and was maintained entirely at the cost of the late Sir John Lawes during his lifetime. In 1889 he constituted a trust for the continuance of the work, setting apart for that purpose the laboratory (which had been built by public subscription and presented to him in 1855), certain areas of land on which the experimental plots were situated, and £100,000. The management is intrusted to a committee comprising four representatives of the Royal Society, two of the Royal Agricultural Society, one of the Chemical Society, one of the Linnean Society, and the owner of Rothamsted estate.

In 1900 Mr. J. F. Mason, M.P., presented the committee with a £1,000 bacteriological laboratory and funds toward its maintenance. In 1907 the Goldsmiths' Company made a grant of £10,000, the income of which is devoted exclusively to the investigation of the soil. The Permanent Nitrate Committee has also made a grant of £2,000 toward the endowment. In 1904 there was organized a "Society for Extending the Rothamsted Experiments," which has collected donations and annual subscriptions toward the undertaking. Finally, in 1911 the Board of Agriculture of the British government announced a plan whereby funds are granted to a certain number of institutions carrying on fundamental research in agriculture, each being designated to receive aid in one great branch of the subject. Rothamsted was selected as the institution for investigations under this plan in soil and plant nutrition problems, and received an annual grant of £2,500. Certain agricultural scholarships have also been instituted, the incumbents of which carry on their work at Rothamsted.

The farm has recently been enlarged by the addition of 230 acres of land, on a seventy-seven years' lease, with the aid of a grant of £3,000 from the government and a like amount raised by the Society for Extending the Rothamsted Experiments.

The most remarkable feature of the work at this institution is the continuity of observations made on the same experimental plots over a long term of years. In the words of the director, "Nowhere else in the world do such data exist for studying the effects of season and manuring upon the yield and quality of the crop, and for watching the progressive changes that are going on in the soil."

One illustration of the value of these long series of observations is the way in which ordinary views and experience as to the importance of crop-rotation have been re-enforced. Wheat was grown on the same plots for sixty-two consecutive years, and the crop yielded at the end of that time only about one fourth as much per acre as wheat grown on similar land for fifty-two years as a part of a four-course rotation. In both cases the land was not fertilized.

The Cholera Granary

OCCIDENTALS hold (theoretically at least) that cleanliness is next to Godliness. Among Orientals, on the other hand, it would seem better to be dirty and holy, than to have clean hands but an impure heart. A step toward the happy combination of personal and religious purity has been taken by the appointment of a commission to inquire into the sanitation of Hindu and Mahometan pilgrimage centers. Here is no doubt a most delicate undertaking, since religious ideas may be involved which the Oriental is likely to adhere to with absolutely unreasoning fanaticism. One need but recall how cartridges greased with pig fat, which the Sepoy were injudiciously expected to extract with their teeth, precipitated the Mutiny, the Calcutta Black Hole and the rest to realize how ticklish might prove the task of grafting Occidental sanitation upon Oriental civilization. And yet if the cholera and like "scourges of Allah" are not every few years to endanger Europe and the Western World, the Eastern granary from which these pestilences are supplied must be cleared out and closed up.

Though cholera does not disappear entirely in winter its essential bacterium loses much of its virulence during hibernation; the disease is not fairly active until the spring, when it is likely to appear, in Russia for example, as the Asiatic guest. And by what route does this visitor travel to its destination? One of two: from Mecca to the Mediterranean countries—Greece, the Adriatic, Italy, Marseilles, Northern Africa, and by way of the Caucasus, the Don, the Dnieper, the Danube northward and westward to Vienna, St. Petersburg, the Baltic and to Berlin and the ports whence transatlantic vessels sail. Mecca has since Mahomet been in some sort a secondary cholera *entrepot*. It is an epic reflection of history that had Mahomet's hegira been made in the winter rather than in the hot season, millions of human lives would not thereafter have ended prematurely. Immeasurable suffering and stupendous material loss would not have come to pass. Awful Mother India has through countless generations fed her children the cholera, especially in the Ganges have they drunk it in and absorbed it while they have sought to purify their souls in that ghastly stream. Thence have the Asiatic Mussulmans, thus saturated with the cholera vibrio, been making their pilgrimages Meccaward—overland by foot or caravan or through the Red Sea by sail and latterly by steam, and now also by the Hedjaz Railroad. It is this railway which especially makes Occidental sanitarians anxious, because it is a much speedier route than by caravan or water, and may get its pilgrim passengers to Mecca during the incubation period of the disease, when it may pass unrecognized.

Most of these pilgrims have been and are absolute fatalists, and neither know nor care about sanitary precautions—in the observing which no "merit is to be acquired" (to use Kipling's superb phrase in "Kim"). So these pilgrims have through the centuries been visiting the Prophet's shrine and have bathed, when they could, in the Holy Wells (it is now forbidden) in order to reach the very pinnacle of holiness and thus has Mecca become a cholera granary subsidiary only to India. Then European and African Mahometans, just as devout and every whit as fatalistic as their Asiatic brethren make their pilgrimages into Arabian Mecca; and these pilgrims, by commingling with their fellow worshipers in the Holy City, have in their own home-coming distributed the dreadful infection to Northern Africa, to Egypt, to Syria and the Mediterranean countries.

Time and the Sciences

TIME and space enter into all our perceptions, and therefore into all scientific observation and reasoning. But not always in the same way, nor with the same emphasis. The biologist of the old school may have been content to collect specimens and to describe them; all this without reference, expressed or implied, to time. A very different attitude is taken by the modern biologist, who centers his interest about problems relating to the development or evolution of the individual and the species—a phenomenon into which the element of time enters very clearly.

Again, it may be safe to say that ninety five per cent of all published work on chemistry makes no reference to time, and this in spite of the fact that the manufacturing chemist is most vitally interested in the time required for the completion of his reactions. This seeming neglect, which has of course been remedied in the development of physical chemistry, is no doubt due largely to the fact that many reactions proceed with considerable speed, so that the time element, while important, takes care of itself, as it were, when all other matters have been duly attended to.

In physical chemistry and physics time plays of course an important and well-recognized rôle. But even here there is a limitation. The question is usually "How long?" or "How fast?" Rarely does the physicist ask "When?" In other words, he is interested in intervals of time, but not ordinarily in concrete points of time. This distinguishes the historical from the other sciences, that they do inquire, not merely after the duration or speed of events, but after their date also. The historical sciences *par excellence* are geology and astronomy. Geology is a very special science, devoted to the unraveling of the past history of our planet. As yet it is almost wholly qualitative. The geologist can tell us the order of sequence of events in the past, but as to the length of the periods involved, he is only beginning to obtain crude estimates. With the future he is not, as a rule, greatly concerned.

To the astronomer we look for the most accurate and most extensive instruction in questions relating to time. He is our court of final appeal when we require an accurate standard unit of time. He studies not only the paths and velocities of the heavenly bodies, nor only their history in the past, but foretells with great accuracy coming events. Astronomy is one of the oldest and one of the most highly developed sciences. Its field is the universe, its period the æons of time.

Crossing the Ocean in a Flying Machine

SOME day the Atlantic Ocean will be crossed by a flying machine—of that those who have followed the development of the aeroplane from its fledgling flights in 1908 to the recent Paris-Berlin trip are fully convinced. Lord Northcliffe's generous offer of a $50,000 prize for the achievement will bring that day measurably nearer than may be suspected, even though it does nothing more than to arouse a world-wide interest in the performance of one of the most difficult technical achievements that still remains unfulfilled.

When Lord Northcliffe made his announcement, sober-minded engineers naturally asked: What are the difficulties in the way? Can the prize be won? If so, how much will it cost?

As we look back at Wellman's attempt to cross the Atlantic in a dirigible, which was admirably designed and which was by far the best craft of its type built in America up to that time, we are inevitably forced to the conclusion that much preliminary experimenting must be done before a heavier-than-air machine can be sent out on its venturesome transatlantic journey with some hope of success. It would be astonishing indeed if considerably more than the amount of Lord Northcliffe's prize were not expended in these preliminary studies. But even granting that by winning the prize the successful contestant would merely recoup himself, he must inevitably have developed the art so markedly that his craft will have commercial possibilities far greater than those which lie in the mere crossing of the Atlantic. Indeed, the whole problem of devising a safe passenger-carrying aeroplane capable of flying for many hours without a stop will probably be solved. Compared with that what is a dash across the Atlantic at its narrowest part?

If we were absolutely sure of motors and absolutely sure of the weather for thirty six hours, a transatlantic flight might even now be attempted from Newfoundland to Ireland. But unfortunately we have no guarantee that a faulty motor will not compel a descent into a choppy sea, and unfortunately the science of meteorology is not so far advanced that we can predict the weather with accuracy for even so short a period as twenty four hours in advance.

Because present motors cannot absolutely be relied upon, leads to a consideration of the problem of alighting upon a rough sea and ascending from great ocean waves, which has not yet been solved. But the remarkable performances of the hydro-aeroplanes at the recent Monaco meeting prove that the solution of the problem may soon be expected. Seven machines ran out of the harbor into the white-capped Mediterranean and in the teeth of a gale. All but one successfully rose from the surface, flew to Beaulieu, a point some miles down the coast, and alighted again upon a rough sea. What is more, Gaubert's performance in alighting and holding his own in a gale by means of a drag, shows what can be done on the high seas even in a storm.

To be sure, these machines were comparatively light, the heaviest weighing only 2,000 pounds. But the meeting proved conclusively that the large machine of high power is not helpless in heavy seas. In our opinion a flying boat of the Curtiss type is likely to be even more successful than the float type which figured at Monaco. In other words, a boat body in which much fuel, two powerful motors, provisions, and at least two aviators can find room—the very requisites for a transatlantic flight—holds out more promise than any other design.

Engineering

Dimensions of the "Britannic."—It is reported that the "Britannic," which is now being built by Harland & Wolff, will be 897 feet 9 inches in length, 94 feet 6 inches in breadth, with a gross tonnage of between 50,000 and 51,000. Although shorter and narrower than the "Aquitania," the "Britannic" will, according to these figures, be about four thousand tons heavier and will even exceed the "Imperator" slightly in tonnage. The "Britannic," which, according to the original plans, was to be launched next March, will probably be ready to take the water by the end of November of this year

A Plant with a 5,412-feet Head.—Work has begun on a hydro-electric power plant in Switzerland, which will use a water head of 5,412 feet. The water will be taken from the lake of Fully near Martigny in Canton Wallis. What such a head means, we may appreciate when considering that the pipe line will have to be constructed to withstand a pressure of 2,425 pounds per square inch at the lower end. The line will be about 2¾ miles long and the pipe will be from 19 11/16 to 23 5/8 inches in diameter inside, while the thickness will vary from 15/64 to 1 25/32 inches. The upper section will be of the well-known lap-welded type, while the pipes of the lower part will be seamless. The turbines will be of 15,000 horse-power The plant is being constructed after the plans of Mr Boucher of Lausanne.

Cloth Pinions.—In place of rawhide or paper for noiseless, shock-absorbing gearing, cloth or cotton fiber pinions are now being used with great satisfaction The cloth is piled up between steel shrouds, subjected to a hydraulic pressure of several tons per square inch, and held in compression by threaded studs passing through both shrouds and filler The teeth are then cut. The pinion is as strong as cast iron. The teeth are elastic enough to come to a good bearing across the full width of the face. They are not affected by atmospheric changes and are not damaged by contact with oil, in fact they are soaked in oil to exclude moisture and furnish constant lubrication. Such gears have been designed for transmitting from 1/6 to 150 horse-power

Machinery Exhibits at the Panama-Pacific Exposition.—Rapid progress is being made in the construction of the main exhibit buildings at the Panama-Pacific International Exposition at San Francisco. There will be fourteen main exhibit buildings. Work upon the Machinery Building, the largest of the exhibit group, was begun early in the year and it will be ready for the complete installation of exhibits by the opening date, February 20th, 1915 The Machinery Building will have nearly eight acres of floor space. There will also be an auxiliary structure to be known as the Gas and Fuels Building Electrical machinery, instead of being placed in a separate building, will be located in the Machinery Building and classed under the general heading of machinery All parts of the building will be served by adequate crane facilities. Electric current, alternating and direct, gas and water, will be available in any portion of the building, compressed air and steam will be provided in a section adjacent to the Gas and Fuels Building General illumination is to be provided by the exposition company, but a nominal charge will be made to exhibitors for other utilities service they desire. Special rates for power will be made to exhibitors who use it to show machinery in motion. The floor of the Machinery Building is designed for a load of two hundred pounds per square foot. No charge will be made for exhibit space.

Frozen Coal Shafts.—It was not until 1883, when Poetsch invented the "freezing method," that Holland's coal fields became of any practical value. The coal is found in the province of Limburg, and, what is more, the two mines near Kerkrade in that province were the very first coal mines operated in continental Europe in medieval times. When, after 1860, the mining industry came to be more seriously considered, and several concessions had been given out by the Dutch government, it was found that the coal layers could not properly be reached, for in every place, except in the two medieval mines near Kerkrade, where coal is encountered immediately under the solid rock, there is a stratum of drift sand that contains great quantities of water. This condition of things made it practically impossible to build the shafts, which had to be of considerable depth, for the coal layers are encountered at a depth of from 300 to 1,000 feet. The freezing method, however, has successfully solved the problem, and Holland now has a flourishing mining industry. On the spot where the shaft is to be dug, from 25 to 30 borings are made down through the drift sand to the solid rock in a circle 5 feet larger in diameter than the projected shaft. Pipes are then sunk into these boreholes, and through these is circulated, by powerful freezing machines, a chemical solution cooled down to minus 20 deg. Cent. In this way the drift sand containing the water is frozen as hard as a rock after the freezing machines have been working day and night for two months. In this frozen cylinder of sand a shaft is then [illegible] from bottom to top with strong segments [illegible] together with [illegible]

Electricity

Wireless Licenses.—During the four months following December 13th, 1912, when the act to regulate radio-communication went into effect, 3,407 licenses have been granted to wireless operators and stations in the United States. Of these 1,185 were granted to amateurs, and 685 amateur stations have been licensed

Street-car Ambulances.—In our issue of April 5th we described a street-car ambulance built in this country for use in Bahia, Brazil One of our readers has called our attention to a car designed and built after the plans of Dr Homan, when Health Commissioner of St Louis, in 1894. Service by this car was inaugurated in December, 1894. Evidently Bahia cannot claim to be the first city to employ an ambulance of this description

Electric Searchlight for Airships.—According to recent information, electric searchlights operated by storage batteries are to be mounted on all the military airships in Germany An arrangement similar to that employed on warships will allow two airships to communicate with each other by the use of luminous signals The storage batteries will be mounted in the forward *nacelle*. Thus equipped it is believed that airships may be employed for nocturnal attacks.

Free Renewal of Tungsten Lamps.—We are informed that the manufacturers of tungsten incandescent lamps have decided to reduce the price of lamps after July 1st. A number of the large Edison companies are anxious to place tungsten lamps on the free renewal basis It is considered probable that the opportunity to do so will be afforded by the reduction in the price of the lamps. This will place the tungsten lamp on the same basis as the carbon filament lamp, with which it is even now a serious competitor

Ozone and Pine Trees.—What is the reason that pine and fir trees, and others of the species, are surrounded, more than other trees, by ozone, and that therefore forests of the "needle-leaved" trees are so health-giving? If the theory of Prof Lemstrom, of Helsingfors, is correct, this can now be explained, for the "needles" act on the atmosphere as generators of electricity, so that the trees are always surrounded by electricity and consequently by ozone Prof Lemstrom began his researches in this direction by studying the uses of the spikes or "beards" of grain (wheat and rve) which he found to be generators of electricity which the plant requires for its proper development

Arc Versus Spark Waves.—The recent radio-telegraphic tests conducted between the scout cruiser "Salem" and the Arlington station have demonstrated that waves produced by the electric arc are less modified by absorption than waves produced by spark apparatus Up to a distance of about nine hundred miles there was very little to choose between the two types of waves It was possible for the Arlington station to reach the "Salem" at a distance of 2,100 miles. But as the distance was increased over two thousand miles, it was found that the waves produced by the electric arc showed a relatively increasing efficiency and possessed an energy much greater than those from the spark apparatus

Cadmium Vapor Lamps.—The mercury vapor lamp would be ideal were it not so deficient in red rays. It has been found that by operating the lamp at much higher temperatures in a quartz tube there is an increase in the emanation of red rays as compared with green and blue rays. But even under such conditions the light it gives does not possess enough red for ordinary commercial purposes. Efforts have been made to find a vapor which will give the desired spectrum. However, the desired end has now apparently been reached by Dr Wolfke, who uses cadmium in the lamp The vapor of cadmium gives an excess of red light when the temperature of the lamp is raised, but this is corrected by adding a small amount of mercury It is stated that a lamp of 3,800 candle-power uses 620 watts.

Meters on the Back Porch.—The railroad town of Renovo in Pennsylvania has adopted the very convenient scheme of placing electric-light meters on the back porches of the houses. In fact, most of the houses are provided with cupboards on the back porch to receive the electric meter. The advantage of this arrangement is that it permits the meter reader to read a great many meters in a day for the reason that he does not have to enter the house. It is a common matter to read 300 meters in a single day. Another advantage is that the meter is placed in a conspicuous place where the consumer may read it from time to time and get better acquainted with it. Much of the trouble over lighting bills is due to the fact that the consumer very seldom reads his meter, so that he is surprised at the end of the month if his bill is larger than usual, whereas if he had watched the meter day by day he might have been able to determine the reason for a sudden increase in the amount of electricity consumed by recalling that on the previous night the lights were burned unusually late or a stormy afternoon made it necessary to turn on the light earlier than usual. Perhaps the principal advantage to the consumer of the back-porch meter is that his house need not be invaded by the meter reader every month.

Aeronautics

A 500-mile, Non-stop, Cross-country Flight.—On May 1st aviator Eugene Gilbert, on a Morane monoplane, made a non-stop flight of 513 miles from Paris to Vittoria, Spain. After resting and refilling his tanks, Gilbert continued for some distance, but finally descended at Medina del Campo, where he broke some of the guys of his monoplane in making a bad landing The time of this flight was 8¼ hours, which is the record for a non-stop cross-country flight.

A Thousand Miles Across Country in 22 Hours.—After a close call from death because of pneumonia, Ernest François Guillaux, a young Frenchman famous for his many flights over Paris, made a trip to Biarritz in his Clement-Bayard monoplane Leaving Biarritz at 4·22 A M on April 27th, this record-breaking youth flew to Bordeaux and thence to Villacoublay, where he made a second stop for replenishment and continued on his flight. He descended the third time in Kollum, Holland, before dawn on the following day, having covered over 1,000 miles in less than 24 hours.

A Record Flight from Paris to Berlin.—In the competition for the Pommery Cup for the longest flight across country in a single day, Pierre Daucourt, on a 50 horse-power Borel monoplane, covered the 555 miles between Paris and Berlin in 8 hours and 44 minutes flying time, or at an average speed of 64 miles an hour The start was made at 5·06 A M, and Liege Belgium 211 miles away, was reached in 2½ hours or at an average speed of nearly 85 miles per hour About 60 miles per hour was averaged from Liege to Hanover, Germany, and 50 miles per hour from Hanover to Berlin As stops some two hours in length were made at Liege and Hanover, the total elapsed time of the flight was around 13 hours, which is excellent when one considers that Audemars required two days in which to make this flight last August This Swiss aviator, on a Morane monoplane, left Villacoublay 15 minutes before Daucourt started in an attempt to beat the French pilot He covered the 130 miles to Mezieres at 87 miles per hour and resuming the flight, crossed the Ardennes at a height of 6,000 feet, and finally landed at Wanne, in Westphalia at 11.30 A M after battling with a very strong head wind throughout the last 60 miles The next day he abandoned the flight because the wind still continued

The First Flight Across the Isthmus.—After several attempts to fly across the Isthmus of Panama by well-known aviators, it remained for Robert S Fowler, the second man who flew across the continent of North America, to accomplish this difficult 40-mile flight Fowler arrived at Panama on April 11th with an 80 horse-power Gage hydro-aeroplane and a cinematograph and man to operate it. The next day he made a ½ hour flight above Panama and took moving pictures of the city After flying over the canal as far as the Pedro Miguel locks and back in the second of two flights made on April 25th, Fowler flew across the Isthmus the whole way above the canal two days later He started at Panama beach at 9 45 A M and, after circling to gain altitude at the entrance to the canal, he headed direct for Colon Encountering a 25-mile breeze at Colon, Fowler continued toward Cristobal but his motor stopped for lack of gasoline and he landed in shallow water The pontoon of his hydro-aeroplane was slightly damaged This flight has been several times attempted by leading aviators but all gave it up because of no chance of alighting on the way, and also because of the air currents in the Culebra Cut.

Constructing Machines on a Scientific Basis.—The Royal Aircraft Factory in Great Britain undertook last year a series of experiments on full-sized aeroplanes with a view to improving their efficiency and stability These experiments were carried out in conjunction with aerodynamical researches at the British National Aero-Dynamical Laboratory After calculating the results that would accrue to two different machines in the laboratory, various changes suggested were made to these machines, and the result was well nigh remarkable With a Farnham biplane, fitted with the same horse-power motor as before, an additional load of 82 pounds was carried as against 80 pounds that laboratory calculation showed should be carried. In addition to this there was an increase of speed of from 37 miles per hour to 47.5, an increase in flexibility or speed variation of from 35 to 37 miles per hour to from 33 to 47.5 miles per hour, an increase in load of 10 per cent, an increase in climbing ability of 100 per cent, a very great increase in stability and ease of control, and a very great increase in total efficiency The improvements in the Government biplane BE2 were very marked indeed Whereas in the Military Aeroplane Competition last fall it was supposed to maintain an air speed of over 55 miles an hour, to climb at the rate of 200 feet per minute to fly fully loaded for three hours, to glide at an angle of 1 in 6, to be capable of landing at 40 miles per hour, and to have a range of speed of 15 miles per hour, the results actually obtained were 72 miles per hour, 480 feet per minute, 5 hours, 1 in 8, 40 miles per hour, and 32 miles per hour respectively.

Stairway for use of the blind guiderailed in the center for ascent and descent

Section of fire escape and stairway leading to roof playground and running track.

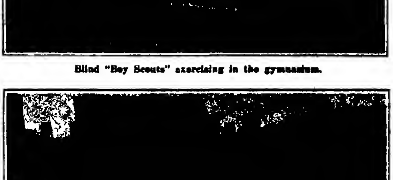
Blind men in the bowling alley find the play an excellent form of pastime.

Training the Sightless

By Walter L. Beasley

THE New York Association for the Blind in the completion and opening of its new building 111 East Fifty ninth Street, has produced the most perfect plant for the manual, educational and social training of the blind in America, or probably in the world The structure is fittingly termed the "Light House" being dedicated for the exclusive benefit and welfare of those who live in eternal night In fact, the opportunities here offered to enable those who are without sight to conquer darkness by learning practical handicrafts, thereby making them self-supporting as wage earners, mark a new era for the emancipation of the blind, industrially and intellectually As complete isolation from the world is now recognized as one of the chief terrors of blindness, and blindness without opportunity is the worst kind of slavery, one of the principal objects the new structure is designed to serve, is to give the independent blind men and women an opportunity to be self-helpful, and again to take their places in the work and play of the sighted world. To teach the blind, therefore actual accomplishments in various fields of useful ness, is the main purpose of the institution. The Light House is a five-story, modern fireproof building of brick with stone frontage. It represents the last word in interior construction and equipment for the development of the physical welfare of the blind. One of the distinctive building features is a combination fire escape with wide stairways and guide-railings, provided also with open air platforms, affording roomy space for tables, chairs, etc Each floor leads out into one of these open galleries, so that at will any activities can be carried on in the fresh air during the summer months. The architect was Mr William Welles Bosworth The accompanying illustrations show some of the unique interior and exterior features of the building adapted to meet the requirements and convenience of the blind. The first floor is devoted to a large weaving and assembly room, with a gallery above. This is filled with a beehive of industrial workers, where many looms are operated by the skillful and ingenious blind women. Here various articles of handicraft are turned out Weaving and the work in basketry have been developed to a high standard Articles that are made by the blind can stand competition and usually surpass in excellence similar ones made by the seeing while draperies, with as many as six different colors, woven in patterns, are successfully turned out by the Light House" weavers. There is perhaps distinction in this blind work from the fact that the artisans are all able to execute without supervision, after a reasonable apprenticeship, all the processes required in their industries. The blind girl threads her loom, which sometimes has as many as four hundred threads, prepares her own material, fastens it to her own shuttle, and weaves the article, including the pattern The only assistance which she gets is the direction as to what colors she is to use and what design she is to follow The second floor is an attractive salesroom, where are displayed and sold to the public the various articles made by the blind, such as furniture, carpets, rugs, woven articles, curtains, draperies, cushions, laces, embroidered portfolios, bags, card cases, baskets, etc. In the rear is located the museum, which contains interesting exhibits representing the industrial, educational and pictorial progress of the blind, from the past to the present The third floor is occupied by the general and special offices, and class rooms for the teaching of adults and children Here is also located the census and registration room, containing a list of over ten thousand names of the blind in greater New York who have been investigated by the association. This work is in charge of Mr W I Scandlin, who, before losing his vision, was a well known editor and authority on photography One of the most noteworthy and essential features in the building is the thorough arrangements provided for physical training and recreation This it appears is more vital to the sightless than to the seeing. The gymnasium, having an experienced instructor, himself partly blind, is fitted with all the latest apparatus to strengthen their users' bodies and to stimulate their wits The accompanying illustration shows a typical animated scene on a Saturday afternoon, when a squad of blind boy scouts are doing some of their exercises. The "Light House" scouts were selected by Sir Robert Baden-Powell to be his honor guard at the great rally given to him by the Boy Scouts of America Probably the crowning feature, bringing the greatest appreciation and joy to the young blind people, is a spacious roof garden forming an ideal playground for roller skating drills, games and dancing in the open air This also has additional attractions, in fact, a decided innovation in city buildings, in the shape of a wide, concrete running track. This occupies a half section of the roof, and the sightless runners find much amusement in getting around the track in real sportsman like fashion. In the basement there are installed other important features for the development of the physical welfare of the blind, a large swimming pool, numerous baths, and a bowling alley A bowling club meets weekly, and this exercise is recognized as a most excellent form of pastime for the blind. One of the accompanying pictures shows a detail of a much frequented stairway leading to the basement and the guide railing employed for the person ascending or descending. Sharp angles and corners are avoided, and this same idea is carried out in all stairways, walls, closets, vestibules, etc, in the building. The New York Association for the Blind is a philanthropic society, supported entirely by voluntary contributions. In the half dozen years of its existence it has accomplished important and far-reaching achievements for the progress of the blind. It secured legislation and the co-operation of health boards, medical associations, etc., for the prevention of blindness. It helped to place the first blind children in the public schools of New York, now there are 160 in attendance. It secured an amendment to the education law, making the education of blind children compulsory, so that they are no longer forced into ignorant and helpless lives, or compelled to become beggars or drudges, It published the first magazine for blind children in this country, *The Searchlight*, printed in Braille. In many other ways it is coping with the problem of blindness and doing continuous helpful and uplifting work in behalf of the blind world The president of the association is Dr John H. Finley, with Helen Keller as one of the vice-presidents. Winifred Holt, the secretary, is especially interested, devoting her time, service and gifts to the welfare of the blind and directing its numerous activities from the "Light House" headquarters. Among the influential members of the practical advisory board is Hon. Thomas P. Gore, the young blind United States Senator from Oklahoma.

Blind "Boy Scouts" exercising in the gymnasium.



Blind boys taking exercise on the roof running track.

The multiple-bladed horizontal and vertical rudders.

A Journey in a Zeppelin

Impressions of a Trip in the Airship "Viktoria Luise"

By Carl Dienstbach

Working the nose of the airship into the shed.

It is the absolute novelty of the sensation that renders it impossible to imagine beforehand just how it feels to journey through the air in the ideal comfort and with the safety and speed which characterize a Zeppelin airship.

The sensation is a combination of the distinct impressions, the bigness, complexity and self-sufficiency of this new world of yours, its complete detachment, and finally, its mighty powers.

Balloons, aeroplanes, smaller airships, cannot impress one so strongly. Their cramped quarters and moderate dimensions do not suggest such a 'world in itself.' Their progress is not so certain. They have the jarring and jerking characteristic of earthly locomotion. But in a Zeppelin one feels as if one were on another planet, circling through space on its prescribed course. One loses the sense of speed, and at times might think himself still hovering in mid air, were it not that the picture below keeps on changing as frequently and quite as softly and smoothly as the floating fancies of a dream.

In the cabin there is complete absence of vibration and noise, for the hum of propellers and motors is as subdued as the rustling of trees and the softest speaking voice is distinctly audible. The motion would suggest the drifting of a spherical balloon were it not that the mind is very quickly impressed by the fact that it is not as aimless. Only when something in this floating panorama below tries to remain, do you realize, with a start, the amount of 'brute force' (nearly 500 horse-power) that keeps your dream going.

If you see the locomotive of an express train with the piston rods vibrating to and fro, gradually falling behind with its tail of waving handkerchiefs on a track that runs parallel to your course, you feel a sudden respect for the driving power of the great propellers fore and aft.

Later a flight of pigeons appears at a lower level, also going in the same direction. They hold their own only for a while—until they turn from our course. In the cabin the air is not at rest. A fitful little breeze, just enough to remind you that you are flying, comes in occasional puffs through the windows, but even outside the air is sucked along by the huge hull, and does not blow against the extended hand with a force corresponding to the ship's velocity. But a hurricane sweeps into the exposed front car. The pilot of an aeroplane meeting the "Viktoria Luise" would behold the unusual sight of a man at the helm in the uniform of a naval sailor wearing automobile goggles. Recently a transparent windshield has been fitted to the "bridge." The crew of the big passenger Zeppelins last summer was partly composed of naval sailors and officers being trained to man the huge new airship of the navy. The peculiar character of the cabin, which on earth drew from almost every visitor to the shed the simple exclamation, "A dining car," appears only after the airship has ascended. After landing it seems to shrink again into insignificance, but a thousand feet up in the air it feels as roomy and as gorgeous as a palace.

The passengers are housed as in an apartment. The aluminium gangway is folded against the wall, opposite the door through which you pass in entering the ship. In front you see the steward's little pantry, with a door opening into the long passageway to the front car and to the machinery and steering devices.

Looking up upon entering you "see heaven" through an "endless" tube, made of canvas and aluminium rings. Closer inspection reveals a double flight of ladder steps fitted against the tube's wall. A short aluminium ladder is also strapped to the side of the passageway that can be locked to the lower end of the tube to complete access to the observation platform (practically a small deck) on top of the hull.

At the rear end of the cabin you pass again through a door to a floor of ribbed aluminium plates. Its right corner serves as a wash room, its left corner is partitioned off for the wireless telegraph. In the center another door opens into the rear passageway—an endless vista, reaching beyond the rear car to the hind most point of the hull, where a man may climb through one of the round, canvas-covered portholes, and out over the frames of the rudders and stabilizing planes to make repairs, a thousand feet above the ground. An engineer is always sent to this porthole shortly after the ship has got under way to inspect the working of the rudders. A narrow path of ribbed aluminium, carried on low steps, forms the floor of the passageways.

In the shed the cabin looks a poor protection against the weather, of the six large windows on each side, the three in the rear are gaping holes. Those in front have such neat and practical panes of 'cellon' that if necessary the rear ones could be at any time equally protected. But when the airship ran into a drenching rain there was not a trace of dampness or discomfort in the cabin. Looking through the paneless windows, one might see whole sheets of water blown to the rear but the wide overhang of the hull above and the speed of the ship, never permitted a side gust to blow any rain toward the windows. To notions acquired in houses or in railroad cars or ships, the airship's cabin seemed protected by magic. It was a pleasure to walk through its length and to think that it was virtually walking on air."

There is so much room that the upholstered willow chairs seem hidden on the sides and never in the way of people passing each other. It was thrilling to hear a footstep far back in the 'hold' hear a door open, and then see an engineer from the rear car, in damp oilcloth, emerge through another door and continue on his way to the front car to report at the "bridge."

There was a coming and going of sailors (aerial apprentices) who complained how nerve-racking the dreadful responsibility" made even their short shifts at the 'wheels" (in an airship there is more than one helm). The strangest sensation after all, was the cruise in cloudland." It was a stormy morning, on the way to the air harbor, heavy showers poured against the windows of the street car. The clouds were hanging low, torn into fantastic and beautiful shapes of all shades between black and white. After ascending the airship was directly among them, several times it ran into them, and all became gray outside and a peculiar odor was noticeable. When we emerged it was uncanny to see the dark masses float by at the level of the ship. But the cabin felt so homelike that any feeling of fear or dizziness was out of the question. Wonderfully reassuring was the fact that one had a roof over one's head, even a beautiful mahogany ceiling.

The sunlit landscape, seen from not too great an altitude, and from a swiftly moving observatory was an experience so novel that no comparison will give a true idea of it. It is different from the view from a mountain because most objects are so much nearer, while from a tower or a skyscraper the lower altitude makes the field of sight comparatively limited. But the determined swift movement of an airship gives the vista the same depth as from a high mountain, yet things appear so much more distinct. The result of this and of the entire lack of such experience is a truly bewildering richness of vision, quite beyond the mind's power to grasp. The most familiar scenery appears disguised to beyond recognition. Well known buildings are the most useful clews to identification, then rivers, ditches, ponds and roads. Forests, trees, hills, the outlines of towns, help but little. In an airship one realizes for the first time how little we see in everyday life. Everything is pitilessly laid bare, secrets seem stripped stark naked. We fly over a village, it is still misty and we pass it quickly. Yet during these few seconds we can make an excellent guess at the fortunes of each inhabitant. We take in all the telltale marks about a stable and learn the number and condition of the stock inside. There is no hiding in a forest, the ground is distinctly visible between the trees and through the branches. If the air is clear enough to use a strong field glass, the same applies to war times and high levels of flight, the one necessary condition being that the line of sight approaches the vertical.

The airship's freedom from any fixed line of travel, except among high mountains, has a very unusual effect. The country through which this trip extended was quite familiar to the visitor yet the airship took him for the first time to two never-visited cities around Frankfurt which were touched on the airline as a matter of course, and just as easily as the

All aboard and ready to cast off

Gliding along easily with the speed of an express train.

other ones where he had been. Even with present high fares, airship travel pays well for the foreign tourist who wants to get acquainted with a country He sees as much of it in hours as otherwise he could get in weeks.

The Hydraulic Ram

TO most people an hydraulic ram is a mystery As a matter of fact, it is the most simple and efficient mechanical device for raising water by water power This is probably what makes it seem so mysterious to those who have never seen a ram at work

Pumping water by hydraulic ram makes a water supply system far superior to any other except a gravity system In some instances it is even better than gravity in matter of expense when a gravity supply requires a long line of pipe A windmill must depend on the wind, a gasoline engine means continuous attention and expense for fuel, an hydraulic ram costs nothing to operate requires no attention, depends upon nothing but the source of supply

Hydraulic rams are not only adaptable for pumping water for household purposes, but they can be used for delivering large quantities of water for irrigation, town water works, railroad tanks, etc. Where the least possible expense must be incurred for pumping water for any of these purposes, there is naturally a great demand for rams This applies particularly to irrigation as it enables the farmer to raise crops at a minimum cost per acre.

Hydraulic rams can derive the power for operating them from a spring brook, flowing artesian well or river, and if the ram can be located at such a point that a constant stream of water can be supplied to it through a pipe having an incline or fall of three or more feet in a given distance the conditions being such that the power water which escapes at the ram can be drained away, it is possible for the ram to deliver a steady stream of water to a point at an elevation thirty times the difference between the levels of the ram and the water supply This stream of water, once started flowing, will continue without interruption day and night, winter and summer, requiring no attention nor expense except for the renewal of rubber valves on the ram once every year or two. This is a trifling expense, as the valves cost but little.

The efficiency of a ram can be very great, reaching, under favorable conditions, 80 per cent or more. This means that the ram will pump more water to the same height than any other kind of engine which pumps water by means of water power

The amount of water that may be pumped per day by such a ram is remarkable. It will pump as much as a quarter of a million gallons a day If a delivery of two million gallons a day is required, a "battery" of rams can be installed That is, two or more rams are placed side by side.

Where pneumatic pressure tanks are used instead of gravity tanks, rams will not only supply the water, but also maintain the air pressure up to 100 pounds, as may be desired.

The Current Supplement

HOW long has the ocean been in existence? This seems a difficult question to answer, yet it is possible to make a fairly good estimate of the age of the ocean, as is shown by F W Clarke in this week's issue of our SUPPLEMENT — Mr R. D Andrews has made a study of the comparative efficiency of Eiffel aeroplane surfaces, which he reports in this issue.— The new Lötschberg Railway, which opens this month, and on which the most powerful electric locomotives of Europe will be in service, is described —I S Stone gives a valuable survey of the facts known regarding the propagation of high frequency currents along wires.— C H Butman discusses the origin of the native American Indians, on the basis of recent investigations in Siberia —A very striking example of protective mimicry is afforded by the coloration of certain butterflies, as is shown in an excellently illustrated article by the Rev F Bennett, M A —Mr Charles H. Clark discusses the cycle of his gear engine

Extending the Erie Canal to Chicago.—Writing in the current issue of the *National Waterways Magazine*, Representative Cyrus Cline, of Indiana, suggests that by canalizing the Maumee River from Toledo to Fort Wayne, a distance of 120 miles, and then cutting through a fairly level country along the shores of Indiana to some point in Lake Michigan, a distance of 120 miles more, the Erie Canal can be extended to Chicago This would provide a direct waterway of sufficient size to float heavy freight from Chicago to New York and eastern cities without reloading It would cut off 850 miles from the existing circuitous round rip between Chicago and Toledo via Lake Michigan, the Straits of Mackinac, Lake Huron, the Detroit River and Lake Erie He asserts that the Erie Canal without the assistance of trade by this direct route to Chicago will not carry ten per cent of the freight it is capable of floating.

A Copper El Dorado in Mid-Africa—The Katanga

By Charles Fitzhugh Talman

AS the leading copper-producing country of the world the United States may soon have a formidable rival in a region that was a few years ago an unknown and trackless wilderness.

Not long since the SCIENTIFIC AMERICAN called attention to the fact that American map-publishers had not yet discovered the existence of the flourishing German seaport of Tsingtau, on the China coast, founded about a decade previously as the administrative center of the colony of Kiaochau. In consequence of our editorial of March 11th, 1911, subsequent editions of American atlases have remedied this particular oversight, without, however, seeming to realize that our criticism applied generally to the amazing "out-of-dateness" of American, as contrasted with European, productions of this class.

Just as the publication in 1910 of a large-scale map of the China coast minus Tsingtau was an enormity, so the publication in 1912 of a large-scale map of Africa minus the Katanga is a characteristic piece of ineptitude on the part of our compatriots. Such a map now lies before us. In conspicuous type it bears the legend "Copyright, 1912," while in an obscure corner, in very inconspicuous type, is the real date of the greater portion of the map, viz., 1895. In view of the latter date it is not surprising to find that the Katanga —whose name has been one to conjure with in the mining circles of the world for the last three or four years at least—is still known to the cartographer as "Msiris Kingdom." The atlas in which this map appears sells

Sketch map of the Katanga.

Railways built ׀׀׀׀ Under construction ׀ ׀ ׀ ׀ Several other lines are in contemplation Elisabethville, the capital of the district, is destined to become one of the important railway centers of the world. It is already in direct railway communication with Cape Town, 2,300 miles distant. The hatchings show regions in which agricultural studies have recently been carried out by an official mission.

for fifteen dollars. As the geographical works at the disposal of most of our readers may be equally defective, we present herewith an up-to-date map of the Katanga

The Katanga is the southernmost district of the Belgian Kongo. Its area is approximately 180,000 square miles, and its population is estimated at one million. Being mainly a lofty table-land, it enjoys a temperate climate and in this respect appears to be better adapted to colonization by white men than any other part of tropical Africa. It is abundantly watered, and has unlimited agricultural resources.

It is, however, the vast mineral wealth of the Katanga that has recently focused the attention of the world upon it, and has already attracted capital to the amount of about $50,000,000. The natural corollary is that not only is the Katanga itself on the eve of being intersected by railways, but it is attracting to it the great trunk lines of the continent, and will soon be a clearing-house for the commerce of southern and central Africa.

Even the most makeshift maps of Africa will show you the seaboard terminals of these lines; Benguela on the west, Mombasa, Dar-es-Salaam, and Beira on the east, and Cape Town on the south. From Benguela a railway is now rapidly pushing across Angola, and will probably connect up with the Katanga system in a very few years. As soon as the latter system extends to the shores of Lake Tanganyika, it will be in communication by water [illegible] German and British [illegible] line from Cape Town [illegible] the Katanga from the south. By next October it is expected to reach Kambove, and next year it will probably be extended to Bukama. From the latter place steamers already ply on the River Lualaba to Kongolo; thence a railway extends to Kindu, whence there is steam and rail communication to the mouth of the Kongo River.

Thus the time is measurably near at hand when Elisabethville, the capital of this flourishing region, will be regarded as the railway center of Africa. This town, which has sprung up over night, and whose population is about 1,300 Europeans and some 10,000 natives, already boasts of numerous comfortable hotels—the principal of which are ambitiously styled the Cecil and the Carlton—public buildings, clubs, and even moving-picture theaters. The value of the buildings erected there last year amounted to $1,350,000.

While gold, tin and diamonds are all mined in the Katanga, the all-important product of the country is copper Its potential wealth in this mineral is said to be almost fabulous. According to G B. Beak, late British vice consul at Elisabethville, the southern copper belt extends 200 miles, with a breadth of 35 to 60 miles, i. e., about 7,000 square miles of territory Quoting from a South African newspaper "The ore bodies are of enormous size. At one mine a cross-cut at the 100-foot level is 427 miles in length, and for 50 feet or more the ore averages 30 per cent copper This mine alone is estimated to produce 30,000 tons yearly Even allowing for the cost of transport, these supplies should be available on the European market at less than $150 a ton. The road is at last cleared for the full development of the great Belgian Kongo copper belt, there now being nothing to prevent the southern portion of the Katanga from becoming another Rand, with Elisabethville as a worthy rival to Johannesburg."

The smelting problem has been provisionally solved by the shipment of coke from Rhodesia, but coke furnaces are about to be installed in the Katanga.

Salving the "Lutine"

By Percival A. Hislam

THE SCIENTIFIC AMERICAN has already dealt at some length with the attempts to salve the valuable cargo of the British frigate "Lutine," which was sunk on the night of October 9-10th, 1799, off the Dutch coast with ten tons of specie on board. When the vessel was wrecked—only one man being saved—she had in her holds 1,000 bars of gold and 500 bars of silver, of a total value of $6,035,000, and in the two previous and rather primitive attempts to get at this (in 1801 and 1857-9) the divers succeeded in getting up the precious metal to the total value of just over half a million dollars.

For the last two years the National Salvage Association of London has been working on the wreck, and Capt. Gardiner, who is in charge of the operations, has every hope of being able during the coming season to raise enough of the specie to pay the speculators a very handsome profit. The wreck is actually the property of Lloyd's. In the first place, it was claimed by the Dutch government, and a company for its salvage was formed in Holland. In 1823, however, the King of Holland made a gift of the vessel to the King of England (George IV), by whom it was transferred to Lloyd's, who had lost $4,500,000 on the insurance of the wreck. The Dutch salvage company still exists and has some sort of claim on whatever may be recovered, while Lloyd's, the present owners, considered salvage totally impossible. The company now engaged on the work is to pay 15 per cent of what is recovered to Lloyd's and another 15 per cent to the Dutch company, retaining 70 per cent for itself.

During 1912 the work was considerably impeded by bad weather, and although the salvage vessel "Lyons" was out for eight months it was only possible to put in 278 hours of work as compared with 836 hours in the previous year Nevertheless, the work that was done was most effective, and Capt. Gardiner is confident that if the conditions in 1913 are at all favorable a large quantity of the treasure will then be brought to the surface. In July last one of the divers found a fair sized hole in the bottom of the vessel, and, on putting his arm through, was able actually to touch the gold bars and to give an almost accurate estimate of their size (they are 7 inches long, 2½ inches wide and 1¼ inches thick) Unfortunately, owing to the removal of the sand from under the bottom, the vessel had canted over when he went down again, the hole being entirely covered.

One of the greatest difficulties with which the salvors have had to contend is the strong current which runs over the wreck. The tides there have a circular motion, and the effect of tides and of strong currents in conjunction was to render abortive all efforts to keep the wreck uncovered [illegible]

... a mile in length, the "Lutine" lying in about ... The wreck lies between the islands of Vlieland and Terschelling, which are in the island fringe surrounding the Zuider Zee, and the effect of cutting the deep channel is to give the currents a clear run from the Zuider Zee into the North Sea, and vice versa; with the result that the channel is kept comparatively clean by currents that run at from 3 to 7 knots. Over 1,500,000 tons of sand were removed in this work, one effect of which has been to increase the depth of water over the wreck from 14 feet to 50 feet. The vessel now lies on a hard clay bottom—so hard, indeed, that a 4-ton gun lying on it has not been able to sink in at all, while a 5 horse-power drill was unable to penetrate more than three feet.

When the matter was last dealt with in the SCIENTIFIC AMERICAN a description was given of a novel device invented by Mr. Simon W Lake, of Bridgeport, Conn., which had been brought to the notice of the salvors as likely to be of assistance to them in their work. It may be described as a long, flexible tube, in which divers would be able to work for a much longer time than usual, and in greater comfort. While there is no doubt that this arrangement would be of considerable value in less troubled waters it is impossible to use it in connection with the "Lutine," owing to the strong currents that have to be contended with, as well as the heavy swell which runs in from the North Sea.

The principal difficulty remaining to be dealt with is presented by the enormous masses of rusted shot and ballast in which the specie is embedded. It must be remembered that the vessel has been lying at the bottom of the sea for 113 years, and that when the bars were taken on board they were placed in the shot rooms under the ammunition, which has become rusted together. During the operations of 1857-9 a diver found a mass of Spanish dollars four feet thick, but was unable to touch them owing to their great weight, and the same misfortune attended the success of another who, a few years later, found a solid pavement of silver bars and rusted iron twelve feet square.

When operations are renewed early in the coming spring the "Lyons" will have on board an electric lifting magnet with a lifting capacity of three tons. The masses of metal will be broken up by means of small charges of explosive into pieces small enough for the magnet to deal with. The magnet, supplied by a firm of Birmingham, Eng., has already proved successful in similar work. One of these magnets was recently used in a London dock, which threatened to become choked up owing to the accumulation of scrap metal, and by its agency about 90 tons were removed in five days. Several other dock companies have now adopted the contrivance, one advantage of which, in the case of the "Lutine," is that it will be possible for a diver to be down while the magnet is working, this being, of course, quite impossible while a powerful sand pump is operating. The magnet will be of the ordinary lifting type, but with special arrangements made to insure its being watertight.

The magnet will be worked from a jib-crane on board the "Lyons," which is an exceptionally large vessel for the work on which she is engaged. She is 198 feet long and 28 feet in beam, with a displacement of 537 tons and engines of 1,650 horse-power. She is equipped with one 20-inch sand-pump, having a capacity of 1,500 tons an hour, and two 12-inch pumps of 390 tons capacity each. She is fitted with blacksmiths', carpenters' and engineer-fitters' workshops, has an electric searchlight enabling work to be continued day and night, and carries a crew of forty-seven. A telephone communicates between the divers and the deck of the vessel.

Capt. C. A. P. Gardiner, who is in charge of the operations, has been occupied in salvage work for a quarter of a century, and has over 120 successful cases—and not one failure—to his credit, so that if anyone can succeed on the "Lutine" he is certainly the man. Perhaps his most interesting "case" occurred at Cadiz, where he happened to be with his salvage vessel when a Spanish merchant ship, bound from the Barbadoes to Barcelona with sugar, ran aground by the bows. Salvage was offered and accepted, the terms being $45,000. Having satisfied himself that the bulkheads of the stranded ship were watertight, Capt. Gardiner took his vessel alongside and proceeded to flood the fore hold. It may perhaps be excused that the Spanish skipper did not understand this maneuver, but he had no excuse for thinking that the salvors wished to sink his ship, or for chasing Capt. Gardiner round the decks with a loaded revolver, as he did. He was, however, got under control, put in irons, and placed in the chart room. When sufficient water had been pumped into the hold a powerful steam pipe was introduced, and before long what had been sugar was a mass of thick thin treacle. It was a simple matter to pump this out, and the ship, being sufficiently lightened by the ... was easily floated off in ... [illegible]

[illegible] ... is being ... [illegible]

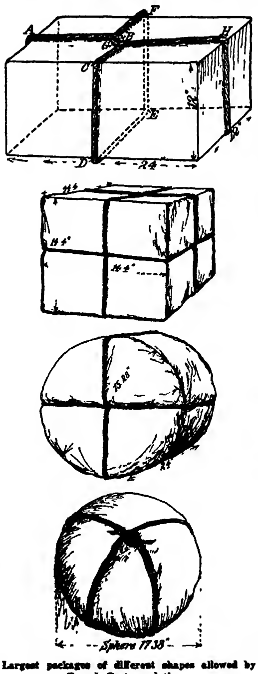
Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Maximum Parcel

To the Editor of the SCIENTIFIC AMERICAN

Under Section 15 of the Parcel Post Regulations, if a parcel exceeds "seventy two inches in length and girth combined, it must be refused, no matter how small the excess may be." In another paragraph of this same Section 15 the measuring of 'combined girth and length" is explained by saying that "in measuring the length the greatest distance in a straight line between the two ends of the parcel shall be taken, while the girth is the actual measurement by a tape encircling the parcel at its thickest part."



Largest packages of different shapes allowed by Parcels Post regulations.

Under these provisions strictly interpreted a rod 72 inches long would have to be infinitely thin to be accepted, and a perfect cube would have to be not more than fourteen and four tenths inches high, because the girth of such a cube is 4 times 14.4 or 57.6 inches, and its length 14.4 added to the girth 57.6 makes 72.0 inches exactly

The 14.4-inch cube contains $14.4 \times 14.4 \times 14.4$ or 2,985.984 cubic inches; and the 72-inch rod contains zero or no cubic inches; and a question that naturally arises is, have we any form between the thin rod and the cube that will enable the shipper to send a still greater number of cubic inches under the rule?

In a rectangular package the square cross section is the most advantageous, so that the problem may be stated in the following form: 'What should be the dimensions of a square bar whose combined girth and length is 72 inches, in order that such bar shall contain the greatest number of cubic inches, and how many cubic inches will it contain?

Let x inches be the width and thickness of this bar, so that its girth will be $4x$ inches. Its length under the rule will be $(72-4x)$ inches. The cross sectional area is x^2 square inches and the volume V is $x^2\,(72-4x)$ cubic inches. We may, therefore, write

$$72x^2-4x^3=V$$

and note that V should be as large as possible or a maximum.

Differentiating for the maximum we have

$$144x-12x^2=dV/dx=0$$

whence

$$x=12.$$

We, therefore, have girth, or $4x$, equals 48 inches, length, or $(72-4x)$, equals 24 inches, cross section, or x^2, equals 144 square inches, volume, or $24x^2$, equals 3,456 cubic inches.

This represents a gain of approximately 3,456—2,986, or 470 cubic inches, which amounts to very nearly 16 per cent, and the package has the advantage of being of a form that is much more conveniently handled than the cube.

The dimensions of this package to recapitulate are 12 inches by 12 inches by 24 inches. It is represented in the annexed rapid perspective, where the combined girth and length is the full length of the string A, B, C, D, E, F, G, and H

A cylinder of the same length, 24 inches, and, therefore, of the same girth, 48 inches, would have a diameter of $48/\pi$ or 15.28 inches, and a volume of almost exactly 4,400 cubic inches.

The sphere of all solids is known to be the one that incloses the greatest volume within a given superficial area, but the largest sphere that could be sent through the mails has a diameter d equal to $72/(\pi+1)$, or 17.38 inches, with a volume V equal to 1/6 of πd^3, or 2,749 cubic inches. Under Parcel Post Regulations, therefore, the spherical form of package which can only be considered as a matter of curiosity, is even less advantageous than the cubical.

A point not to be overlooked is that in any case the weight limit of eleven pounds must not be exceeded

Arlington, Va — JOSEPH BECKER.

The Levee Question

To the Editor of the SCIENTIFIC AMERICAN

About twenty years ago, on the occasion of examinations of old Mississippi River pilots on the question of whether a piece of land was an accretion or island, I took advantage of the opportunities to discuss with them the question whether the levees raised or lowered the bottom of the river. It was their opinion that they raised the bottom and would eventually cause the bottom to be higher than the land at the sides. It seems to me that if the levees increased the current to the extent that the water carried with it the silt, it would be a mass of mud before reaching New Orleans. The theory of opening up through headlands and allowing a straight course to the sea as a panacea has an objection in that it would cause such a current that the river in its course would pick up much more silt on account of its force. Should such a course be pursued, the river would probably be unnavigable on account of the current then, also, the effect of such a current against a bank would be disastrous. Should not the river be allowed to follow its natural course, spreading out over and enriching and raising the level of the land along its borders on certain occasions? Would it not be better to learn to use the land according to the laws of nature and not to struggle ineffectually against them?

The question of leveeing, when near me the years I lived in the Mississippi Valley raised the legal question in my mind as to whether the levees could be legally built, in view of the fact that they changed the natural course of the flow and raised the water of other land, and at the time the question of whether or not the building of levees on the Arkansas side of the river, raising the flood level in Tennessee, would not be stopped by injunction issued in the Federal Court.

Mobile, Ala. — GEORGE B. CLEVELAND, JR.

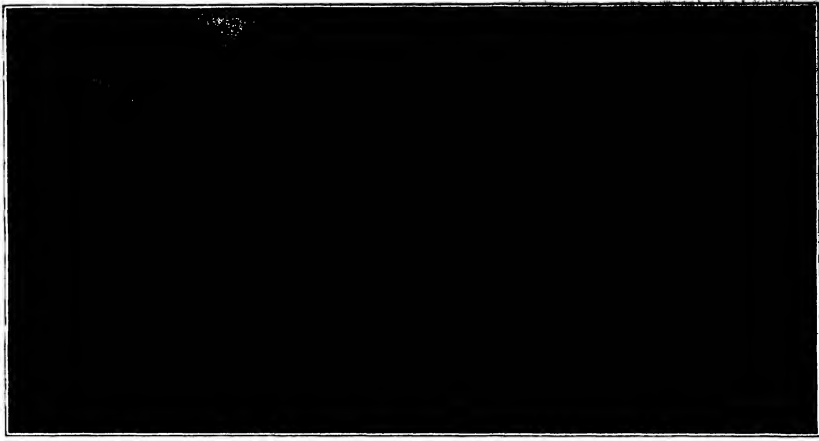
Forth and Clyde Battleship Canal

To the Editor of the SCIENTIFIC AMERICAN

With reference to the notice of the above project in your issue of March 29th last, permit me to point out through your correspondence columns, that the British government has promised state aid to the project on certain conditions. (See page 1 of the accompanying reprint of the engineer's lecture to the Royal Scottish Society of Arts on January 31st, 1910.) The altered strategical conditions under which the home battle squadrons of the British fleet are now placed have rendered the construction of the ship canal an imperative necessity, and the question is now mainly one of terms between the treasury and the canal promoters. I would further point out that the ship canal would be of the utmost commercial importance to the maritime traffic passing between the New World and north central Europe.

MAJOR CHILTON L. ADDISON SMITH

Edinburgh, Scotland.



View toward the village of Gampel and the Rhone valley.

The Lötschberg or Bernese Alpine Railway

Modern Engineering for the Benefit of the Tourist

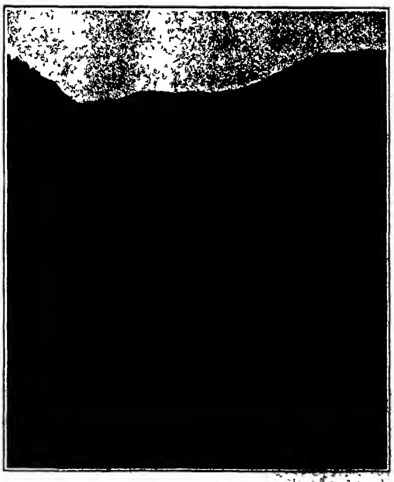
By Dr. Alfred Gradenwitz

Switzerland's great industry is to cater to the tourist, and in this endeavor all modern resources are strained. The current month sees the opening of another most picturesque railway line, connecting Lake Thun with the Simplon tunnel. Interest in Swiss travel is so general that we feel sure our readers will welcome an account of the new line. Those who seek more detailed information will find it in this week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT.—EDITOR.

SINCE the granite wall of the Alps was first pierced thirty years ago, in order to lay through the St. Gotthard range a railway on which Italy, the land of poets and artists, could be reached more comfortably, numerous railways and tunnels have been created by the art of engineers and the enterprise of capitalists. The St. Gotthard tunnel, 14 kilometers in length, has long been outdone by the Simplon tunnel, and the most grandiose schemes in bridge and viaduct construction have been realized in connection with the new Berne-Lötschberg-Simplon Railway, to be inaugurated during the current month, which combines with the most daring technical structures an abundance of surpassingly beautiful scenery to an extent never approximately afforded by any other railway line. The Lötschberg line leads through the Bernese Alps from Frutigen to Brigue in the Rhone valley, and links up, on one hand, the country round the Lake of Thun, Berne and Interlaken, in fact the Bernese Oberland, with Upper Valais, the Upper Rhone valley—especially with the magnificent mountain and tourist center of Zermatt and Saas-Fee—and on the other hand through the directly-connected Simplon tunnel with the splendid Lago Maggiore, the Borromean Islands and the industrial and traffic center of Upper Italy, Milan, Turin and Genoa.

But the Bernese Alpine Railway is also of international importance, offering as it does to travelers from Germany to Italy a route in every way equivalent to the St. Gotthard line, which affords the additional advantage of a perfect absence of smoke, due to the adoption of electric traction.

In fact, this is the first Alpine railway of more than local importance for which electric traction has been planned at the outset. The daring spirit in which it was conceived is the more to be admired as at the time of its inception no technical appliances able to comply with the extraordinary demands of the occasion had yet been evolved. Thanks to the initiative of the railway company, these means have now been created by the construction of locomotives more powerful than any steam locomotives in Europe, and the first section from Spiez to Frutigen has been converted into a trial line for these new engines. The speed of the trains, in spite of the high gradients of the line, which are equal to those of the St. Gotthard, Arlberg and Mont Cenis routes, exceeds the figures reached on these lines. In order to illustrate the power of the new electric locomotives, it may be said that each of them can draw a train weighing 310 tons on a gradient of 27 per mille, which is the international standard fixed as a maximum, whereas in the case of steam traction two powerful engines are required for the same performance. The Bernese Alpine Railway comprises the lines of Thun-Spiez-Frutigen-Kandersteg-Brigue and Spiez-Interlaken-Bönigen; the company also runs steamships on the lakes of Thun and Brienz. The Simplon tunnel, which has been open to traffic since 1906, is also operated by electricity.



Luegelkinn viaduct, 128 meters long; five 20-meter spans; height, 50 meters.

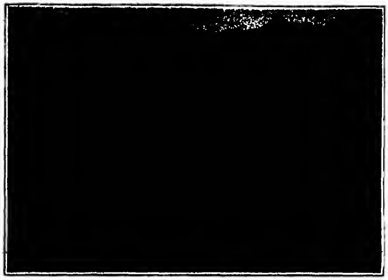
The starting point of the Lötschberg or Bernese Alpine Railway is at Spiez, on the Lake of Thun, where it connects with the Lake Thun Railway. After passing a short tunnel through the Hondrich, it enters the Kander valley beyond Spiez. At Mülenen is effected the transfer to the electric cableway leading to the wonderful Belvedere of Mont Niesen (7,755 feet). After Reichenbach, the intermediate station for the Kien valley, with its wealth of Alps, Frutigen, until now the terminus of the line, is reached.

The new line of Frutigen-Brigue, after crossing the Kander, rises slowly up the mountain slope on a high viaduct, and at Blau See describes a large double loop, partly in a loop tunnel. Travelers thus see the romantic ruins of the Felsenburg castle at first above, then beside, and finally below themselves. Before reaching Kandersteg, the railway runs alongside the Kander Falls. Throughout the journey the traveler's eye is fascinated by the iceclad mountain giants, Altels and Balmhorn, Rinderhorn, the Doldenhorn, peaks of Blümlisalp, the bold [illegible] and [illegible], all of which [illegible] the

lovely health resort of Kandersteg. The Lötschberg tunnel, 14,605 meters in length, pierces the Fisistöcke, passing below the Gastern valley and the Lötschen pass, in order again to emerge at Goppenstein. Farther uphill, the Lötschen valley, dominated by the huge Bietschhorn, opens out into a gorge of delightfully genuine Alpine character, which, like few others, has been so far left practically untouched by the tourist traffic. The Bietsch gorge is crossed on a most picturesque iron bridge, comprising a main span of 317 feet and two side openings, each of 140 feet.

At Hohten, the railway enters the Rhone valley, where the marveling eye of the traveler enjoys an incomparably beautiful view of the valley reaching to 1,460 feet below, the wonderful mountain outline on the south of the valley and the numberless brown villages and cottages with here and there the white church steeples. Somewhat gradually it then makes its way down to Brigue, crossing on numerous grandiose viaducts the northern affluents of the Rhone, and piercing in twenty-one tunnels the projecting rocky rib of the mountains. The view enjoyed in the vicinity of Ausserberg, on Visp, lying far down in the valley, and the mountains of the Nicolai valley, the Nadelhorn and Taschhorn, is of surpassing beauty. From Brigue the Federal Railway trains take the traveler in a few minutes to Visp, where the cars of the Visp-Zermatt Railway bound for the grand glacier and peak regions of Zermatt and Saas Fee are waiting for him, whereas in a northeastern direction the mail road passes through the Goms and the quaint villages of Upper Valais, in order, at Gletsch on the Rhone glacier, to connect with the Grimsel and Furka passes. Straight on, in a southeasterly direction, the electric locomotive, however, takes him through the longest tunnel in the world, the Simplon tunnel, 19,803 meters in length, to Domodossola, to the wonderful shores of Lago Maggiore and farther on, to the flourishing cities of Upper Italy, Milan, Turin, and Genoa.

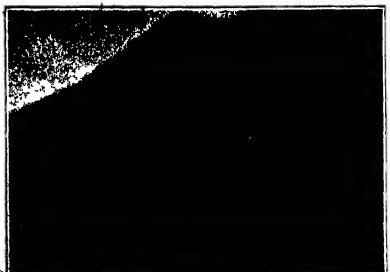
The line from Spiez to Brigue is 48.48 miles in length and reaches its highest point (4,100 feet) in the middle of the Lötschberg tunnel. It opens up new districts of Switzerland to human traffic and gives access to countless jewels of the Alpine world.



Bridge above Mitthols.

The Baltschieder Gorge viaduct

Bridge over the Bietsch Gorge



View showing three railway lines above one another.

The Smithsonian Institution and the Aero Club of Washington Celebrate Langley Day

IN commemoration of the work of the eminent pioneer of the air, the late Samuel Pierpont Langley, secretary of the Smithsonian Institution 1887 to 1906, the Institution and the Aero Club of Washington united on May 6th, 1913, in celebrating the seventeenth anniversary of the first aeroplane flight, that of Mr Langley's model steam aerodrome No. 5, which twice flew successfully over the Potomac River at Quantico, Va., May 6th, 1896.

The first part of the exercises took place in the main hall of the Smithsonian Building at 2.30 P. M., when the Langley tablet was unveiled, and the Langley medals awarded to Mr Glenn H. Curtiss and Monsieur Gustave Eiffel for experimentation and progress in the science of aerodynamics. Addresses were delivered by Dr Alexander Graham Bell and Dr John Alfred Brashear of Allegheny, Pa. Owing to the absence of M Eiffel, his Excellency the French ambassador received the medal in his behalf.

The second part of the celebration was held at 4 o'clock on the grounds of the Army War College, and consisted of a reception by the Aero Club, followed by hydro-aeroplane maneuvers.

Although Mr Langley's first successful aerodrome was only a model, it has been accorded the place of the first ship of the air, since it was without doubt the first heavier-than-air machine to fly, propelled by its own power. Many years of incessant labor, repeated disappointments, and much public misconception, were encountered before Mr Langley achieved his purpose and demonstrated to the world the practicability of mechanical flight. The success attending his experiments with steam models in 1896 led him to continue his work in perfecting his gasoline models, known as the quarter-sized models, which also flew successfully, and he then undertook, for the War Department, the construction of a steel man-carrying machine, which although practically perfect in every point, failed to fly during the two trials held in 1903, due to a defect in the launching apparatus. This excited the ridicule of the press and the public, which neither understood the real cause of the accident in the launching apparatus nor appreciated that such a Government experiment must be conducted in secret, and what was an accident was termed a failure. Mr Langley was discouraged and nearly heart-broken and never again attempted to fly the large machine, which is even to-day the peer of its kind, both in its lines and construction, and its remarkably light and powerful gasoline engine. This machine and the various models that preceded it are safely housed in the Institution where they were built.

When the Wright brothers had made their successful experiments they remarked that the inspiration of many of their early studies and much of their enthusiasm emanated from the work of Mr Langley. People then began to study his researches seriously and were not long in realizing the great importance of the principles which he had discovered and the data which he had assembled. They recalled with *regret the disparagement* they had offered by untimely criticism.

In 1911 the Aero Club of Washington planned to celebrate the event of the first flight of a machine heavier than air by exercises held annually on the 6th of May, which was to be known as Langley day. The third celebration of this event was a fitting tribute to Mr Langley and his sincere efforts toward establishing a new science.

In commemoration of Mr Langley's researches in aeronautics, the Board of Regents of the Smithsonian Institution caused to be prepared an oblong tablet of bronze measuring four feet six inches high by two feet five inches wide, cast from a design by Mr John Flanagan. It represents the late secretary seated on an open terrace watching the flight of birds, while at the same time he sees in his mind's eye his aerodrome soaring high above them. The tablet bears the following inscription:

Samuel Pierpont Langley
1834-1906

Secretary of the Smithsonian Institution
1887-1906

Discovered the relations of speed and angle of inclination to the lifting power of surfaces moving in air

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"I have brought to a close the portion of the work which seemed to be specially mine, the demonstration of the practicability of mechanical flight.

"The great universal highway overhead is now soon to be opened."—Langley, 1901.

The Langley medal was established by the Board of Regents on December 15th 1908, in memory of Secretary Langley and his contributions to the science of aerodromics, to be awarded for specially meritorious investigations in the science of aerodromics and its application to aviation. The Wright brothers were the first to receive this medal in 1910, when it was awarded to them "for advancing the science of aerodromics in its application to aviation by their successful investigations and by their successful demonstrations of the practicability of mechanical flight by man." As already mentioned the medal was conferred this year upon two other investigators, Mr Glenn H Curtiss, the well known American aviator and Monsieur Gustave Eiffel, the eminent French student of aerodynamics and aviation.

Thinking Horses

A Problem in Animal Psychology, or in Stage Trickery?

By the Berlin Correspondent of the Scientific American

THE first duty of the scientific investigator is to record his observations. Explanation must follow after. Ordinarily this principle hardly requires emphasis, but when the observations recorded are marvelous to the degree of being well nigh incredible it behooves us to consider the facts first and hold in reserve our opinion as to their significance.

The reports which we have heard for some time past of horses that read, do sums in arithmetic, and even spell out spontaneously their "thoughts," would probably be utterly ignored by scientific men, were they not—at least in part—authenticated by persons of unquestionable authority and integrity. As it is, we must accept the facts, whatever their meaning may be.

It will be remembered that some years ago a certain Herr von Osten astonished the world by the performances of his horse "Der kluge Hans," which at the time were accepted by some eminent men of science as giving evidence of remarkable reasoning powers of the equine brain. Then came destructive criticism, seemingly crushing criticism, from Dr. O. Pfungst, who claimed to have demonstrated that the horse took his clue for his replies to questions set him, from signals given no doubt involuntarily—by his master. Thus, if the horse were stamping out a reply—so many beats of his hoof—his master would, when the right number was reached, give indication of the fact by an involuntary gesture. Dr. Pfungst's criticism seemed well founded, though perhaps to some it may have seemed that a horse who would react to such slight indications was almost as clever as one that could read. However this may be, the matter was not to be disposed of thus lightly.

Newspaper notices on Herr von Osten's horse had aroused the interest of Mr. Karl Krall of Elberfeld, who, though a prominent business man, had always taken an active part in scientific and psychological problems. When in May, 1906, after the publication of Dr. Pfungst's negative certificate, public interest in Clever Hans seemed to have definitely vanished, Krall went to see Herr von Osten and his pupil and volunteered his collaboration in the task of disproving the adverse criticism of the acknowledged representatives of psychological science. Special precautions were taken which seemed to preclude any possibility of signaling, yet the horse worked his problems as well as before.

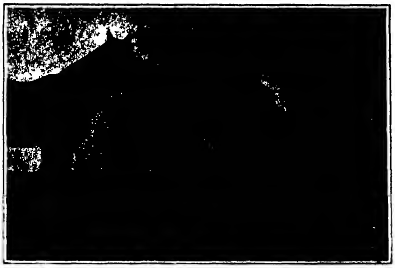
In order to ascertain whether Hans' accomplishments were the outcome of exceptional capacities or of normal equine intelligence, Krall then purchased two young Arab steeds, Muhamed and Zarif. The instruction of these horses commenced on November 2nd, 1908, and was carried out in a simplified and rational manner, on the main lines of von Osten's method, but with some modifications to avoid certain defects. According to von Osten's method each figure was indicated by a corresponding number of beats of the hoof. Krall taught his horses to indicate the tens with the left and the units with the right hoof. After only three days' teaching the horses were able to recognize the first figures, 1, 2, 3, written on the board, touching with their mouths the number pronounced by the teacher. After 10 days Muhamed could count as far as 4. Some days afterward his teacher explained to him the significance of the tens and the use of his left foot in striking the tens and of the right in marking the units. On November 14th, i. e., 12 days after the first lesson, Muhamed did correctly a whole series of simple sums, 1 + 3, 2 + 5, etc., and even subtractions, such as 8 — 3. On November 18th, Mr. Krall proceeded to teach multiplication and division, and on the 21st, fractions and sums of fractions. In December, Muhamed learned some French and was now able to solve his tasks in arithmetic both when enunciated in French and German. In the month of May of the following year Muhamed could extract square roots, cube roots, and solve all sorts of complex problems, which seemed to exceed the powers of human arithmeticians, apart from calculating prodigies.

In February, 1909, commenced the reading or spelling lessons. A conventional alphabet, in which each letter or diphthong is represented by a figure intermediary between 11 and 66, was used in this connection. Zarif was thus able, after four months' tuition, of his own accord to spell any words pronounced before him, even though he had never seen them written. A rather peculiar fact is that both horses would, with the greatest obstinacy, cling to phonetic spelling, which they would vary on different occasions in a manner which seems to show that they were really seeking to render the sound of the word. The word *Pferd (horse)*, pronounced approximately *pfeird*, was, for instance, spelled on different days in the following different ways:

By Muhamed.—*bfert, bfrt, färd, fert, frt, fadrt, faerd, feert, färb, fpferd, frrt, pärd, pfärt, ppeerd, pfer, pferd, ffert, fad.*

By Zarif.—*bferd, färed, fferiet, feert, pfrde, adfert, pfert, bffet, fdaerp*, etc.

Mr Krall and his thinking horses. Zarif on the left and Muhamed on the right.



Zarif is having his lesson in spelling

The latest addition to Mr. Krall's animal school

The following account of a "conversation" held with the horses in the presence of Dr. Hermann Dekker may serve to give some idea of the remarkable claims made for the thinking horse. Muhamed happened to be ill, being lame on one hind leg. The veterinary surgeon, Herr Mittman, had just called and had prescribed water compresses, which Albert, the groom, had to put on. Dr. Dekker was introduced to Zarif in the following manner: "This gentleman is also a doctor, like Dr. Mittman, who called yesterday to see Muhamed. However, he is a doctor for men and not for horses." After half an hour's calculating and spelling exercises with Zarif, the horse was asked "Do you still know the gentleman's name?" and Zarif telegraphed in his own code "Dgr," which is the correct equivalent of Dekker. "What is the gentleman?" "Dgtr." "Is there not a letter missing?" "O." "At which place?" "2."

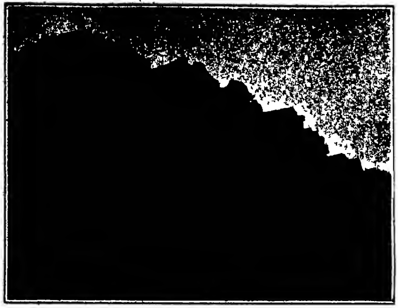
A short time ago Krall added to his party of thinking horses a pony called "Hänschen" and a blind horse "Berto." The results obtained with the latter are especially remarkable. The horse being in addition devoid of any sense of smell, could only receive outside impressions through the ear or his sense of touch, both of which were found to be highly developed. As the animal moreover turned out to be remarkably gifted for "arithmetical" exercises, he after a week or two was able to do any simple addition, subtraction, multiplication or division read out to him or written on his skin.

In view of von Osten's sad experience Krall refrained for some years from making the results of his work public and has only recently told the story of his horses in a book called "Thinking Animals (Denkende Tiere), Contributions to Animal Psychology on the Basis of Personal Experiments." This publication aroused a sensation throughout the German scientific world and even abroad, two camps being soon formed of enthusiastic supporters and obstinate opponents respectively. A number of prominent psychologists have submitted the horses to a strict examination, without, however, reaching any final conclusion.

Such are the accounts of some of the remarkable feats reported from the repertoire of these "learned" horses. And what are we to think of them? It will be wise to reserve our opinion for the present. But a criticism offered by M. Quinton is much to the point. He draws attention to the remarkable fact that these horses extract square and cube roots with apparently the same facility as they do simple additions and subtractions. This seems to indicate clearly, according to M. Quinton, that the performance depends on some trick or unconscious collusion between the master and the horse. That it is possible for a human being of ordinary arithmetical faculties to [illegible]

[illegible] Heap of French Machinery at Panama

[illegible] idea of the operations of the French at the Panama Canal, and their [illegible] outlay for machinery, may be had by looking at the accompanying photograph. This hill of junk collected at Mount Hope consisted of French machinery which has been rusting for years and wasting away in the damp tropical climate. An enterprising house-wrecking company of Chicago has purchased the material from the Isthmian Canal Commission and is now gathering it and turning it into scrap to be shipped to the United States. Over forty thousand tons have been brought to Mount Hope. But this represents only a part of the material yet to be collected, the quantity of which cannot be estimated accurately. Included in the pile so far recovered are twelve abandoned ladder and construction dredges. Already some of this material has been loaded on a steamship and transported to this country. The miserable heap tells a pitiful story of ruined hopes and ambitions caused by official mismanagement and grasping treachery.



"Bleaching bones" of French endeavors at Panama.

Machine for Testing Files

LIKE the proverbial pudding, the proof of the file is in the eating. In order to determine the value of a given type of file, it is necessary to know how long and at what rate it will eat into a test piece of metal. A machine has been constructed which will put a file to this test. The file is held between two head stocks mounted on a reciprocating table, whose stroke can be varied from nothing to six inches. One of the head stocks is provided with a handwheel and screw for adjusting the file with its working face parallel to the direction of motion. The file is drawn back and forth against the end of a test bar, which is pressed upward by means of a weight and chain. Thus a constant pressure is given throughout the cutting stroke. On the back stroke provision is made to withdraw the bar in order to prevent useless wear of the teeth, and to reproduce as far as possible the operation of a good mechanic in using a file. The machine carries a recording drum on which is a sheet of section paper. The drum is geared to revolve slightly with each stroke of the file, one inch of its periphery representing ten thousand strokes. Connected to the test bar which is filed away, is a pencil which moves longitudinally across the drum as the bar is filed away. The result of the continued movement of the drum and the pencil is a curve which shows what the file was doing at every instant of the test. The test is continued until the teeth of the file are so dulled that they cease to cut.

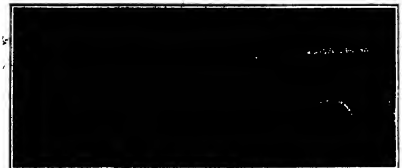
Testing the life of a file.

The largest single leaf bascule bridge.

Paris Motor Garbage Truck

THE street cleaning department of Paris has been thoroughly "automobilized." Motor sprinklers flush the streets, motor sweepers brush the dirt to one side, and motor refuse wagons cart away the garbage of the householder and the sweepings of the streets. Only a few months ago a special commission, appointed by the city of Paris, made a thorough test of a new type of motor refuse truck in front of the Hotel de Ville. The commission laid great stress upon the fact that the transportation of refuse material must not be accompanied with dust. Consequently, the vehicle had to be completely inclosed. The last truck tested by the commission is illustrated in the accompanying two engravings. It is an electrical vehicle of great carrying capacity. The principal feature is the hermetic closure of the body. The covers are movable on rails.

Paris' electric garbage truck; the body hermetically closed.



The motor garbage truck being inspected by a commission.

Ship-cleaning Brush

HITHERTO, when it was necessary to clean the hull of a vessel, the vessel had to be put in drydock to enable the [illegible] by hand. Such treatment is necessary very frequently, particularly in tropical waters, but owing to the difficulty and expense of putting the ship in drydock it is apt to be neglected until the hull of the vessel is in a very bad condition. In order to expedite the work and enable it to be done without docking the vessel, an inventor, Gustav Julius Kindermann of Wayville, South Australia, has designed a brush driven by electric motors which may be lowered over the side of the boat and operated under water. There is a motor at each end of the brush, and they are encased in water-tight casings. The casings are provided with spring pressed buffers to keep the brush at a fixed distance from the ship while it is being hauled around under the hull. The brush is dragged under the hull by means of chains attached to the casings. The chains pass down opposite sides of the vessel and are connected to winches on the deck or if preferred, the device may be operated from floats on each side of the vessel. The brush may be fitted either with wire bristles for scouring purposes, or with a cutting attachment for use when the marine growth is particularly hard.

[illegible] brush for cleaning ship hulls.

The Largest Single Leaf Bascule Bridge in the World

THE bridge recently completed for the B and O Railroad across the Calumet River at South Chicago, is the largest single leaf bascule bridge in the world. The total length of span is 235 feet, the weight of the steel work is 1,300 tons and the counterweight 2,000 tons. This whole mass is moved in the remarkably short space of 1¼ minutes, control being effected from the operator's cabin in precisely the same way as a street car is handled and with no more trouble. The bridge was built in the open position, that is, the leaf was vertical, and traffic was maintained on the old structure while the new was in process of construction. After the entire structure had been completed in this position it was lowered in place and was then found to be less than ⅝ inch out of alignment. The bridge is of the heel trunnion type. In this type the leaf and the counterweight are separately mounted and are connected by a link forming part of a parallel link mechanism, the resultant action of the parts being that the center of gravity of the entire structure that is the leaf and counterweight moves neither vertically nor horizontally. Therefore the only effort required to operate the structure is that necessary to overcome friction and wind resistance. Furthermore the reactions on the piers are vertical and constant throughout the entire operation of the bridge, and the size of the piers is much smaller than has heretofore been possible in bascule construction. While the bridge is normally operated by electricity, a gasoline engine drive is provided for emergency operation.

The Origin of the American Indians

DR. A. HRDLICKA, of the United States National Museum, has recently made an extensive visit to southeastern Siberia and northern Mongolia, for the express purpose of seeking possible remains of the race that peopled America, i. e., the ancestors of the American Indians. He investigated both the contents of ancient burial mounds and the Asiatic tribes of the present day, and in both cases found much more evidence than he expected. He concludes that there exist to-day over large parts of eastern Siberia and in Mongolia, Tibet, and other regions in that part of the world, numerous remains, which now form constituent parts of more modern tribes or nations, of a more ancient population, perhaps related in origin to the latest palæolithic Europeans, which was physically identical with and in all probability gave rise to the American Indians. He reports a vast and rich field for anthropological and archæological research in eastern Asia.

Inventions New and Interesting

Simple Patent Law, Patent Office News; Notes on Trademarks

A Lock on the Gasoline Feed

THERE is so great a prevalence of automobile thievery in this country, especially in and around the larger cities, and so much irritation and annoyance incidental to the theft of a car that any device effective against this evil and sufficiently convenient of operation to insure its regular use should be welcomed by automobile owners.

A device is now being placed on the market which prevents thievery by placing a lock on the gasoline feed. It consists of a Yale pin tumbler cylinder lock located within a very substantial spherical brass casting, a shaft extending downward from this ball head protected by telescoped guard tubes of steel and geared to the lock cylinder within the ball head, and a one-way valve located at the lower end of the shaft. Means are provided for securely and neatly bolting the ball head to the dash, and the construction is such as to make it practically impossible to detach the device from the dash when locked.

The gasoline lock.

Dashboard of a car showing the location of the lock. Thus the theft of a car is prevented.

The valve is installed in the gasoline feed pipe by means of a double compression joint on each side of the valve. A thumb button is located on the face of the ball head, and it requires merely a quarter turn of this button to close and lock the valve. The key, therefore, is not needed for this operation and consequently it requires only one second of time to lock the device. The insertion of the key and a quarter turn of the thumb button back to its original position unlocks and opens the device. Yale locks are used, and of course, no two keys are alike.

The guard tubes and shaft are of adjustable design and are supplied in four different lengths, so that the device may be installed on any make of automobile. The benefits claimed for this device are that it absolutely precludes a leaky carbureter, it materially lessens the chances and dangers of back firing, and it prevents theft of the machine.

The James Internal Combustion Engine

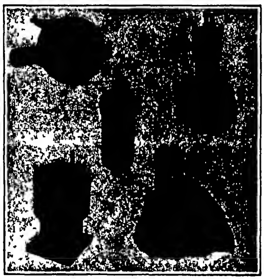
THE main objection to the ordinary internal combustion engine in use on automobiles is the noise caused by the operation of the well known puppet or mushroom valves. Except for this objection, these valves serve their purpose admirably, but the gear for operating them, with its cams, tappet rods and springs, is objectionable on account of the ease with which the various parts get out of order and are broken.

An interesting engine, recently invented by T. S. James of Chiswick, London, England, does away with the usual puppet valve and its accompanying gear and uses instead a single rotary sleeve valve actuated from the crank shaft by a mutilated gear placed upon the periphery of two flywheels. This engine, on account of its simplicity, the fewness of its parts and the cheapness of its manufacture, it is claimed, will revolutionize all gas engine construction.

The James engine, as seen in the figures, is a four-cycle gas engine in which a single rotary sleeve valve performs the functions of the usual inlet and exhaust valves. This valve is fitted over the reciprocating piston and is operated by two mutilated worm gears mounted on the periphery of a pair of flywheels inside the crank casing, the valve being provided with teeth on its lower part which mesh with the worm gearing on the flywheels.

The cylinder head contains two ports, one for the inlet and one for the exhaust, between which is placed the usual spark plug. The upper end of the valve has four ports which successively register with the inlet port, spark plug and exhaust port in the cylinder head to produce the suction, compression and exhaust strokes of the engine. It will thus be seen that these ports are automatically cleansed every few revolutions. The valve is also provided centrally with a stem over which the cylinder head is fitted. A set of nuts on this stem provides for the adjustment of the valve in relation to the cylinder head, the last being secured to the casing by the usual bolts. The teeth on the valve and worm gears are so related as to provide for proper timing for the various strokes of the engine.

By this construction the valve is moved only when under atmospheric pressure, no movement taking place during the compression or during the expansion strokes, and, since the two surfaces between the cylinder head and the valve are ground flat, it is said no leakage can occur. It is also claimed that there is no difficulty in the lubrication and no danger of overheating.



A new four-cycle gas engine.

Fig. 1.—Detachable combustion head showing slots and sparking plug. Fig. 2.—Open-ended cylinder inside which the sleeve works. Fig. 3.—Internal rotating sleeve showing parts which register with slots in cylinder head. Fig. 4.—Worm on the rim of flywheel and driving ring which it operates. Fig. 5.—Complete air cooled engine showing simple appearance.

A Phonographic Alarm Clock

By Walter Isendahl

IT is now possible to purchase an alarm clock which calls the hour in a clear human voice, instead of announcing it by the ringing of a bell. The phonographic alarm clock is not a new invention. A clock of this sort was shown at the Paris exposition in 1900, but it was very different from the new clock described below. The Paris clock was a huge construction, which resembled a clothes-press. It stood six feet high, weighed a hundred pounds and cost about $2,500, while the new clock is only 16 inches high and costs only $25. It can be adjusted to call out each quarter of every hour, and the call can be repeated by pressing a button. When it is used as an alarm clock, the alarm pointer is set at the desired hour—say, seven o'clock. Promptly at the stroke of seven the clock begins to call "Seven o'clock! Seven o'clock! Seven o'clock!" and continues calling until the alarm is turned off or until 15 minutes have elapsed, when the call is changed to "Seven fifteen! Seven fifteen!" and so on.

At any time during the night a touch on a button evokes the proper call for the current quarter hour. Calls in thirty five languages are provided, and the change from one language to another is easily effected.

The mechanism of the speaking clock is simple in principle. The phonograph record is made on an endless band about 2 inches wide and 40 inches long which is carried by a number of cylinders. The 48 calls which are required in order to announce each quarter-hour of the twelve hours, are recorded in 48 parallel grooves, each of which occupies the whole length of the band. The reproducing needle has a sapphire point, and the record band is made of very hard material. When the band is injured by use or accident a new one can be substituted without difficulty.

The needle is kept accurately in the proper groove by a spring device, similar to that employed in computing machines, which is so contrived that the clock can be set by turning the hands either forward or backward, without waiting to allow the intervening quarter-hours to be called. In the operation of setting the clock, the needle moves across the band without touching it, and when the clock is started, the needle falls accurately into the groove corresponding to the changed time. If, however, the hands should be moved while a call was being uttered, the needle would be dragged across the grooves and the record would be injured. The sound is intensified by a small horn, which is in closed in the clock case.

The accompanying illustrations show the external appearance and the interior mechanism of the clock. The talking mechanism is in the lower part, between the vertical plates $P_1 P_2$ (Fig. 1) and beneath the horizontal plate P_3, which supports the clock train and alarm mechanism. The clock work has an anchor escapement, protected by a cap h. The regulator can be adjusted from the outside by means of a slit in the dial. By moving the lever f a piece of clock spring can be inserted through a slit into the cap h, in order to stop the balance wheel transportation, or to start the wheel if it should fail to start spontaneously. H is the alarm lever, actuated by the spring F. The alarm can be stopped by pressing the button A, which protrudes from the case.

The driving spring of the phonograph is contained in the barrel O (Fig. 2), and the winding post, pinion and wheel are indicated respectively by B, E and G. The last wheel of the phonograph train Y (Fig. 1) engages with the endless screw of the regulator J. The lever K (Fig. 1), connected with the time clock, keeps the phonograph regulator and train motionless until the proper moment, when the lever falls and releases the phonograph mechanism. The record band is then drawn along by the traction cylinder W,

Fig. 1.—Front view of mechanism of phonographic alarm clock.

Fig. 2.—Rear view of mechanism of phonographic alarm clock.

which bears pins that engage in holes in the band. The movement is rapid, as the band moves through its entire length of 40 inches for each call.

The manner in which the long band is stowed and kept taut in the small case is shown in the illustrations. From the cylinder B^1 (at the bottom of Fig. 2) the band passes under the works to the front, and around the cylinder R_1 (Fig. 1), whence it ascends, passes over the traction cylinder W and around the small cylinders R_2 and R_3 (Fig. 2) to R_1, the arbitrary starting point.

A very ingenious mechanism is employed to bring the reproducing needle accurately to the record groove corresponding to the time. The arbor b (Fig. 1), connected with the time clock, makes one revolution in 12 hours and carries a large ratchet wheel S, having 48 teeth, upon which rests a lever connected with the reproducing membrane M (Fig. 2). This lever is pressed against the wheel S by the train of levers p k l, operated by the triple cam u, which is mounted on an arbor of the phonograph train. This arbor turns in the cam with a degree of friction which does not impede the movement of the phonograph train when the cam is motionless, during the utterance of a call.

The mechanism for suppressing the calls during the night is illustrated in Fig. 1. Behind the wheel S is a small wheel, which engages with a wheel m of twice its own diameter, which consequently makes one revolution in 24 hours. The hollow shaft of the wheel m turns with friction on the long shaft b', which carries at its inner end an eccentric n and at its outer end a pointer that can be turned to any desired mark on the alarm dial N, which is divided into 24-hour spaces. The clock remains silent for 12 hours from the time to which the pointer is set.

The clock can also be silenced completely or partially by turning the knob L attached to the lever l (Fig. 1). In the position shown in Fig. 1 this lever suppresses the calls entirely by pressing against a pin r' of the phonograph regulator J. When the knob L is turned 90 degrees to the left the calls are made only during the 12 hours in which they are not suppressed by the setting of the pointer of the alarm dial N, as described above. By giving the knob L another quarter turn to the left the lever l strikes the pin o and thereby eliminates the action of the pointer, so that the quarter hours are called throughout the day and night.

The horn is suspended by its rim from the support T (Fig. 2), and swings freely, so that it can follow the motion of the reproducing membrane.

Some Expired Patents

AMONG the important patents granted in 1896 and expiring in the present year 1913 are the following. The reciprocating cotton chopper of Summers, 573,369, of December 15th, 1896, the check rowing, drilling and planting machine of Kaylor, 555,319, February 25th, 1896; the force feed seeding machine of Ham, 564,424, July 21st, 1896, the seeding machine of Morse, 557,010, March 24th, 1896, the Outram patent, 569,298, of October 13th, 1896, which provided for separating the thrashed grain from the straw and disposing of the straw by pneumatic means, No. 574,121 of December 29th, 1896, and 557,069 of March 24th, 1896, to Swenson, and 558,171 of April 14th, 1896, to Griffin embodying the volute type of cotton press, the Baron cigarette machine patent, No. 555,417; the patent 566,058 to Bunn for cigar rolling machine, the Wilson patent, 567,210, for removing liquid elements from garbage and the like; the Sternberg patent of March 31st, 1896, for obtaining ammonia from waste lyes from beet root molasses by subjecting said lyes to incandescence in presence of a contact body; the patent to Gallet, 568,660, relating to the chemical purification of water; the Dutton [illegible] lock patent, 557,684; patent 564,905 to Lieban for partition for use in buildings, the Greenshield patent, 567,232, for traveling machine for setting railway tie plates, the mechanical furnace stoker of Dodge, 565,334, the coal or ore loading patent, 558,200, to McMyler, the Long patent, 560,727, for a coal tipple, the straw stacker patent, 569,504, to Landis, the Philips and Hunt patent, 570,880, for distribution of grain in a car, the truck ladder patent, 568,909, to Young, the Kapp patent, 570,599, for preventing the electrolysis of water in gas pipes by currents from power circuits, the Tillman patent, 573,496, for safety system for electric railways, the tank flushing patents, 566,770 and 566,771, to Kenney, the hydraulic press of Graves, 565,111, 560,993, to Heston for valve for water distribution, the Richards patents, 560,647, 562,662, 568,581, for pedaling features of bicycles, the Sperry patents, 571,409 and 574,120, for electric railway brakes, the interlocking of motor reversing and brake controlling switch patent, 560,751, to Potter, the Applegate patent, 568,226, for metal insert cast in face of brake shoe, the Nobel patent, 563,600, for ring sabots for projectiles to prevent hot gas from injuring the gun.

The naval gun mount patent of Dashiell, No. 573,210, the disappearing gun patent, No. 555,426, of Buffington and Crozier, and 556,926 of Dawson, the Ebbets patent, No. 570,888, for magazine gun, the Bakewell patent, 572,401, in which it is attempted to render dynamite non sensitive to the shock of a gun discharge by freezing it to make it suitable for a bursting charge for shells, the Curtis steam turbine patent, No. 566,969, the Canm patent, 564,069, for lubricator in which air pressure is utilized to force the oil to the point of use, the lubricator patent, 556,074, to Tippett, in which the oil is displaced by condensation of steam, the Butler lubricator patent, 564,508, the Hall and Espey fire lighter for fire engines, in which a vial of sulphuric acid is broken into a box containing a mixture of potassium chlorate, sulphur, and sugar or the like, acetylene gas generator patents, including Dickerson 553,781, Clark 556,730, Porter 562,911, and Bucher 569,273, the automatic glass bottle machine patent of Blue, 567,071, the Mather patent, 555,650, for the manufacture of inlaid linoleum or floor cloth, patent to Laster, 552,914, for repairing defective worn asphalt pavements, the Wotherill patent, 555,702, for the separation of metals of finely differing magnetic susceptibilities, the Preston patent, 555,882, for the field ration mess kit used by the United States troops in the war with Spain, the bottle labeling machine of Kohl, 573,667, the can labeling machine patent of Pettee, No. 560,324 the box machine patents, 556,996, 556,997, and 557,516 to Loyons and Paulson, the match box shuck making machine patent, 554,987, to Corkhill, Jr., the interlocking cell case patent, 573,947, to Williams, the Bonsack cigarette machine patent, 565,853, the Gronbe patent, 566,075, for fixing wires or threads in envelopes to assist in opening the same, the Scott patent, 558,424, for associating folding and delivering printed matter from a rotary press, the bed and cylinder printing press of Miehle, 574,207, the typewriting machine patents to Daugherty, 558,158, and Wagner, 559,345, the book typewriter patents to Fisher, 560,625 and 560,627, and to Elliott, 573,061, the power typewriter patent to Seiden, 557,289; the electrical typewriter patents to Davis, 560,572 and 560,573, and Cahill, 566,442; the Timewell patent, 562,438, for machine for sewing the mouth of a filled bag; the Gammon patent, 555,479, for machine for sewing sweat band into a hat body, the Dees patent, 555,037, for log sawing machine, the Davidson patent, 561,869, for sawing machine, the wood turning lathe patents to Topping, 572,726, and Elder and Kelly, 569,488, the calculator machine patent to Felt, 568,021, patent 567,815 to Honis for fare register, the weighing machine patent, 570,303, to Richards; the Olivari clarinet patent, 570,647; the Cowles patent, 564,474, for closing the doors of ships from bridge or pilot house, the Gordon life-saving patent, 572,109, the screw propeller patents of Bray, 554,831, and Hubbard, 573,977, the Obry patent, 562,235, for automatic steering device embodying gyroscopic mechanism, the Wernicke & Burr sectional or knock-down book-case patent, 557,746, the all glass show-case patent, 561,339, of Pollard, and the Hurlbut patent, 563,664, for sanitary flushing pipe spittoon.

Legal Notes

Article on Process Patent Rejected.—The Court of Appeals of the District of Columbia in the case of *ex parte* Griffith has held that claims for a composite metal article are unpatentable in view of applicant's process patent issued twelve years prior to the filing of the application for the article and in which prior patent is disclosed "the very process by which the product covered by these claims is initially produced."

Eagle Pencil Company Trade-mark Case.—In affirming the decision of the Commissioner of Patents *in re* Eagle Pencil Company, the Court of Appeals of the District of Columbia holds that a trade-mark for pen and pencil holders consisting of a circumferential band of red color contrasting with a yellow or gilt color was properly refused registration in view of the prior registration of marks consisting of circumferential bands of different colors applied to goods of the same descriptive properties.

Some New Court of Appeals Rules.—The Court of Appeals of the District of Columbia has promulgated under date of February 4th, 1913, some rules looking toward reducing the expenses of appeals by a restriction of the printed records. The rules also provide that it shall be permissible for counsel for the respective parties subject to the approval of the Commissioner of Patents to agree upon a statement of the case setting forth the questions raised by appeal and so much only of the evidence as may be necessary to a decision of such questions. The new rules are important to inventors since they will result in a material saving of expense in appealing from the Commissioner of Patents to the Court.

An Appeal from the Philippine Supreme Court.—The Supreme Court of the United States in the appeal from the Supreme Court of the Philippine Islands in Ubeda v Zialcita has held that one whose registered trade-mark is manifestly an imitation of an earlier but unregistered trade-mark cannot restrain a third party from using it and that imposition on the public is not a good ground on which the plaintiff can come into court but it is a very good ground for keeping him out. In the course of the decision Mr Justice Holmes, who delivered the opinion of the Court, said "With or without right, the earlier trade-mark was in widespread use and well known, and the obvious intent and necessary effect of imitating it was to steal some of the good-will attaching to it and to defraud the public."

Design Patent Sustained.—In the case of *Theodore W Foster & Bro Co v Tilden-Thurber Company*, the Circuit Court of Appeals, First Circuit, Circuit Judges Colt, Putnam and Dodge, decision by Justice Dodge, has affirmed the decree of the District Court and held that the clothes brush patented July 26th, 1910, No 40,789, is a proper subject for a design patent, also that a patent may be granted for a design although its ornamental character consists merely in a new and original shape given to an article of manufacture. In the District Court the patent was held valid and infringed. The decision of the Circuit Court goes on to say that the record contains evidence tending to show that clothes brushes of the patented design have been found acceptable in a trade where attractiveness of appearance is a matter of importance. The District Court thought this evidence sufficient for the conclusion that the design shows a patentable degree of artistic invention "and we are of the same opinion."

Notes for Inventors

A Curbstone Footlight.—A street-lighting device, patented by Thomas S. Brown of Hemet, Cal, No 1,045,253, includes in combination with a street curb, a hood somewhat similar to a footlight hood together with means for securing the hood in place upon the curb and an electric light mounted in the hood.

A Combined Bed, Chair and Table in One.—By an ingenious arrangement of lazy tongs, and links of various lengths in connection with platform sections, Theodor Engstrand of Dansville, N Y in patent No 1,046,103 provides a single article of furniture which can be adjusted to serve as either a table, a chair or a bed.

A Megaphone Ear Drum.—In patent No 1,045,812 John B Campbell of New York city presents an artificial ear drum having a megaphone arranged within it and adapted to concentrate sound waves passing into the drum. The smaller end of the megaphone is connected with the inner end or apex of the drum.

A New Arc-lamp Globe.—The General Electric Company, as assignee of John T H Dempster of Schenectady, in patent No 1,046,152 describes an arc-lamp globe of siliceous material on whose inner surface is applied a solidified layer of light-transmitting resinous varnish which protects the globe from direct contact with particles which have chemical affinity with it.

The Biter Bitten.—For preventing dogs from worrying sheep, William Graham of Cookshire, Quebec, Can, in a patent, No 1,046,177, describes a device which has a ring member secured in practice to the nose of the dog and a hook is rigidly secured to the ring so that it will become entangled in the wool of the sheep that the dog may try to worry so that when the sheep starts to run he will pull upon the ring to pull the dog's nose.

A Gasoline Engine Starter.—Webb Jay, of Chicago, Ill, in a patent, No 1,052,826, shows a gasoline engine which is provided with a by-pass conduit around the usual carbureter through which by-pass explosive fluid additional to that supplied through the carbureter may be supplied to the cylinder or cylinders by the suction created in the cylinder in starting the engine. The by-pass conduit is provided with a valve which can be opened at will by the operator.

A Novel Union Suit.—In patent No 1,057,602, Kirk H White of Oswego, N Y, assignor of one half to Marshall S. Ely, of New York city, is presented a union suit which has about its middle portion a two-part elastic band which extends around the garment with the part of the band at the front of the garment elastic in a horizontal direction and that part across the back of the garment elastic vertically, so that the elasticity at the waist line is secured at the front of the garment and up and down at the back of the garment, as desired.

Indicates Proximity of Icebergs at Sea.—In a patent, No 1,057,807, to Willard G Day of Baltimore, Md, is disclosed an apparatus for indicating the proximity of icebergs, in which there is a flexible strip having an exposed side and a protected side together with means to direct the air to the exposed side of the strip and devices are provided by which the deflection of the strip by certain variations in temperature will operate to produce an alarm and thus indicate the presence of an iceberg in the vicinity.

A Self-returning Stylus Groove for Gramophone Records.—A novel form of gramophone record is shown in patent No 1,046,650 to Cornelius Leonard Rotheudt of Walheim, near Aacohn, Germany, in which the disk has a return groove carried across the turns of the record groove and connecting the ends of the record groove so that when the stylus reaches the inner end of the record groove it will be automatically returned to its starting point. The return groove is carried in a parabolic curve across the turns of the record groove and in operation so long as the motor continues to work the record will be repeated over and over.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

SWIMMING SUIT.—S. ROTH, 162 E. 103rd St., New York, N. Y. This invention comprises certain improvements especially designed to be used in connection with submarines for the purpose of enabling the members of the crew of the submarine vessel to escape therefrom in case of accident and make their way safely to the surface of the water.

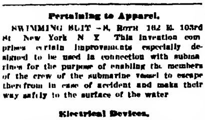
Electrical Devices.

ELECTRIC INDICATOR.—F. J. BEANS and W. I. AKERS, address the latter care of Mass. Bonding and Ins. Co., Old Nat'l Bank Bldg., Spokane, Wash. The purpose here is to produce an indicator more particularly for indicating the designations of streets and the like, which is operated automatically by movements of a car or other piece of rolling stock and provided with means for indicating the streets in reverse order in case the car or other piece of rolling stock happens to run backward during a trip.

Of Interest to Farmers.

MOTOR DISK PLOW.—J. M. HANTON, Edgemont, S. D. The invention provides means for rotating the disk independently of the progression of the plow; provides means for rotating the plowing disks at a variable speed greater than the travel of the plow; provides means on the disks for cross cutting or grooving the bottom of furrows made by the disks; and provides a simplified transmission mechanism whereby power is transmitted from an engine to the plowing disks.

CORN PLANTER.—A. F. STAAB, 177 W. 37th St., Los Angeles, Cal. The purpose of this inventor is to provide a new and improved corn planter arranged to plant or drill a plurality of rows at one time, to properly prepare the ground for the reception of the seeds,



CORN PLANTER.

and to subsequently cover the seed to insure ready germination thereof. Four rows can be planted at once and the seed-containing vessels can be readily removed and refilled when necessary.

Of General Interest.

PACK HITCH.—A. B. WATERS, Republic, Wash. The object in this case is to provide an inexpensive device for use in permitting a pack to be quickly loaded and secured in place without the use of ropes or the like which are liable to slip and to loosen the load.

DIAL MOUNTING.—B. PETTERSEN, Ortonville, Minn. The invention provides a mounting for securing the watch dial in position with respect to the watch frame and other like purposes by means of which the dial can be securely held in position, notwithstanding that it can be readily released and removed when desired, which adds little to the weight and size of the structure with which it is employed and which can be manipulated with ease and rapidity.

LOOSE LEAF BINDER.—W. A. OVERBECK, 310 So. 3rd St. East, Salt Lake City, Utah. The principal purpose of the inventor is to provide a loose leaf binder which will open in a flat condition, the means for holding the leaves within the binder being improved in that such means is flexible, the construction and arrangement being such that the outfit will permit rough usage without being injured.

CASE FOR HYPODERMIC SYRINGES.—F. S. DICKINSON, care of Becton & Dickinson, E. Rutherford, N. J. The case holds a hypodermic syringe, a plurality of needles and a number of vials adapted to contain medicinal liquid preparations for charging the syringe prior to making a desired injection, the arrangement being such that the syringe, needles and vials are securely held in place to prevent rattling, and can be readily removed for use without danger of breaking the vials, or marring the labels.

WINDOW PLATFORM.—J. DRAECK, L. B. 484, Sault Ste Marie, Mich. This invention relates to temporary scaffold or the like and has particular reference to means to permit access to the outside of a window for any purpose such as cleaning, glazing, painting, etc. It may be manipulated by one person from the inside and is adapted to various widths of windows or to walls of different thicknesses and forms.

FLUSHING APPARATUS.—N. J. GONDOLF, 708 State St., New Orleans, La. The siphon is started by a jet of water supplied directly by the water supply pipe, and a valve controls both the water inlet pipe and the jet pipe for starting the siphon. The valve is so arranged as to close the branch leading to the siphon and the inlet pipe in succession, so that the branch pipe is first closed and then the inlet pipe.

SOAP DISPENSING RECEPTACLE.—S. F. KOHN, 190 Brown Place, corner 138th St., New York, N. Y. In the present patent the principal object which the invention has in view is the provision of a receptacle adapted for employment to hold soap or similar material in cake or bar form, and to hold and to dispense saponacious powder.

APPARATUS FOR THE MANUFACTURE OF METALLIC ZINC.—R. D. LANCE, 6 bis Rue de Sartoris, La Garenne-Colombes, Seine, France. The invention refers to devices for manufacturing metallic zinc and zinc white. It provides for reducing zinc oxid which will accomplish the reduction at comparatively low cost. The retorts are located in chambers, whose temperature may be readily controlled so as to obtain the most suitable temperature for carrying out portions of the process.

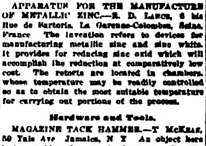
Hardware and Tools.

MAGAZINE TACK HAMMER.—T. MCKEAG, 59 Yale Ave., Jamaica, N. Y. An object here is to provide a hammer having means for successively feeding the tacks adjacent the head of the hammer. Further, to provide means for holding a tack exposed and in position for being initially driven into a body, the driving to be later finished by a blow of the hammer head itself.

ROOF SQUARE.—P. N. HERGESEN, 228 Pomona Ave., San Jose, Cal. This square is especially fitted for roof work, but equally adapted for any work wherein an ordinary or bevel square may be used, which will be easily manipulated to indicate the correct angle and locked in the required position, and which when not in use may be folded into small compass.

PIPE WRENCH.—D. S. SEBASTIAN, Wallace, Idaho. This wrench is particularly of that type used by plumbers or others for handling pipes or rods. The inventor's primary object is to improve this type of wrenches with respect to quickness of adjustment, reliability of securing such adjustment, and the increase of the gripping effect of the jaws.

ICE CREEPER.—C. FRINTER, Ardsley, N. Y. This article is more especially designed for use by pedestrians to prevent the same from



ICE CREEPER.

falling on slippery surfaces and the invention permits of securely fastening the creeper to the heel of a shoe or boot or removing it therefrom before entering a building, and allows adjustment of the parts for different sized heels.

Heating and Lighting.

HEATING APPARATUS.—A. H. BAUM and A. SCHOSL, 42 Lafayette St., Waterloo, Iowa. This improvement provides a heater adapted for installation in the usual fire opening of a chimney breast, employing water as a storage medium, and provides a boiler for the heater simple and economical and adapted to provide free and easy circulation of heated air.

Household Utilities.

WINDOW CURTAIN OPERATING MECHANISM.—F. W. ADLOW, New Baden, Tex. The invention provides means for operating a curtain which is positive and independent of springs or other devices subject to disorganization, and provides a mechanism adapted for operation to lift the curtain from the sill of the window upward.

WEATHER STRIP OR SEAL FOR SLIDING WINDOW SASHES.—R. W. CROSS, 718 Mastea St., Dallas, Tex. This inventor provides a strip which will effectually and automatically seal the meeting edges of the upper and lower sashes of windows wherein the sashes have a sliding movement with relation to each other in the frame, for the purpose of opening and closing the window.

Machines and Mechanical Devices.

MOVING PICTURE SCREEN.—F. E. THOMASON, care of N. A. Cooke, Trust Bldg., Charlotte, N. C. The object here is to provide a screen which may be operated to present a plain white surface for receiving the display of the pictures, or which may be operated to present a display of advertisements or the like when the pictures are not being displayed.

CLOTH ORNAMENTING MACHINE.—G. W. PARKINSON and R. S. TOMPKINS, care of Louis W. Stotesbury, 33 Liberty St., Fishkill-on-the-Hudson, N. Y. This invention relates to hat-making machinery, and provides a machine more especially designed for ornamenting into the surface of felt, wool, fur or other material used in making hats or caps, so that the said material presents a surface in close imitation of corduroy, stitching or the like.

WEIGHING MACHINE.—A. SMITH and C. SOUTHALL, engineers, Villa Street Works, Birmingham, England. The invention relates to machines for weighing tea, coffee, flour, cocoa, wheat, maize, seeds and other granular, pulverulent, powdered and like materials, the object being to provide mechanical means for controlling the operations of the sluices, valves, cut-offs or the like.

LOOM SHUTTLE.—W. H. WILSON, 7 Bedford St., New Bedford, Mass. This invention relates to self-threading shuttles such as shown and described in Patent No. 987,534 granted to Mr. Wilson. The present invention provides a shuttle arranged to permit of securely fastening the thread-retaining device in place in the shuttle body and to prevent the thread from catching or ballooning.

FOOT-POWER MOTOR.—W. E. WEED and F. STEVENS, Roundup, Mont. The more particular purpose of this invention is to provide a type of continuous drive motor operated by the feet somewhat after the manner of pedaling a bicycle, and adapted to drive various kinds of light mechanisms, such as churns, ice cream freezers, washing machines, drills, pumps, punches, and the like.

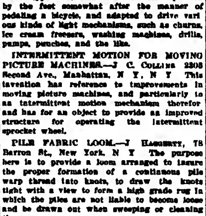
INTERMITTENT MOTION FOR MOVING PICTURE MACHINES.—J. C. COLLINS, 2308 Second Ave., Manhattan, N. Y., N. Y. This invention has reference to improvements in moving picture machines, and particularly to an intermittent motion mechanism therefor and has for an object to provide an improved structure for operating the intermittent sprocket wheel.

PILE FABRIC LOOM.—J. HAGGERTY, 78 Barron St., New York, N. Y. The purpose here is to provide a loom arranged to insure the proper formation of a continuous pile warp thread into knots, to draw the knots tight with a view to form a high grade rug in which the piles are not liable to become loose and be drawn out when sweeping or cleaning the rug.

Railways and Their Accessories.

AUTOMATIC BRAKE VALVE MECHANISM FOR CARS.—J. JUDGE, 166 William St., Pittston, Pa. This invention provides a means for automatically opening a valve in the train pipe of a car when a truck on the car is damaged. When the axle is broken, when the wheel is broken or jumps the track, or when the track spreads or the rail is broken permitting the car wheel to fall to the ties, the axle will bear down on the member which will operate the valve through the levers and the rod to open the train pipe, thereby applying the brakes.

CAR BRAKE.—C. M. ROCHAMBEAU, 2617 So. 18th St., St. Joseph, Mo. This invention relates to railway rolling stock and has particular reference to a form of hand operated brake



CAR BRAKE.

for freight cars or the like, whereby the trainman or brakeman will have better control of a car, especially in a switch yard where the cars are being handled in detached relation to the engine than has hitherto been possible with the ordinary forms of brakes.

RAIL JOINT.—H. SOUDER and W. S. LEAHY, Lebanon, Pa. In this case the invention relates to rail joints of the class in which the securing bolts are each locked in place by a single wedge plate, and the object is to provide a construction which is such as to prevent lateral movement and binding of the bolts in operating the plate to lock the bolts, and to provide means for moving and locking the plate.

Pertaining to Vehicles.

AUTOMOBILE BODY.—F. [illegible], Washington, Miss. In general appearance the body exterior is not changed by the invention. Using standard designs of regular [illegible] provision [illegible] the body into a [illegible] providing an arrangement of a [illegible] to a [illegible] it to [illegible] a horizontal position between a forward and rear seat [illegible] to form a couch.

AIR PUMP.—C. M. SCOTT, 312 W. 6th St., San Angelo, Tex. The aim of this invention is attained by positioning an air pump upon a wheel with a fluid connection between the pump and the tire, the pump being actuated at will by gearing the pump piston actuating means with a stationary element on the vehicle, so that the revolving of the wheel itself will actuate the pump.

TRACTION WHEEL AND MEANS FOR DRIVING SAME.—M. A. GRALEY, 1221 Wood St., Texarkana, Tex. The object here is to construct and mount wheels on hollow axles so that they may be driven by a shaft disposed in the hollow axles, the gearing by which the vehicle wheels are driven being disposed within the plane of the sides of the tires, plates being secured to the tires to inclose the gearing.

WAGON ATTACHMENT.—J. D. HAMMONS, Room 824 Security Bldg., Galveston, Tex. The inventor provides a child's wagon with a device having a foot rest on which one foot of the operator may rest while the operator pushes it with his other foot, the device being so constructed that it may be moved out of the way to permit of the use of the wagon in the customary manner.

DRIVING MECHANISM FOR MOTOR VEHICLES.—J. D. ROWLAND, director of Warne, Wright & Rowland, Limited, 56-60 Watery Lane, Birmingham, England. This invention relates to driving mechanism for, more especially, four wheel motor road vehicles of the belt or chain driven type, and has for its object to provide means for controlling such mechanism. Mechanism connected with an expansionable pulley is adapted to permit operation of the pulley independently of the rear axle as well as conjointly with the said axle.

TIRE CHAIN.—D. J. MARTIN, 30 E. 120th St., New York, N. Y. This invention relates to anti-skid devices adapted to be positioned about the tire of the traction wheel, and particularly relates to means for maintaining the chains in spaced-apart position on the tire. It provides an auxiliary reinforcement for the tread-engaging portion of the tire, to hold the device in position on the wheel even should some of the tread-links of the chain construction break.

MOTOR VEHICLE.—C. H. KUYPER, 3646 Zumstein Ave., Hyde Park, Cincinnati, Ohio. This invention relates to motor vehicles, particularly to vehicles on the order of the two-wheeled vehicle, and has for an object the arrangement of improved means for providing

MOTOR VEHICLE.

the effect of an automobile body at a minimum cost with the use of a minimum number of parts, including the use of only a pair of supporting traction wheels. Means provide for supporting a comparatively large seat, and most of the various operating parts of the vehicle on the order of an ordinary chassis, but utilizing only a single front and a single rear supporting wheel.

Designs.

DESIGN FOR A BATHING CAP.—J. R. PARKER, care of Parker, Stearns & Co., 300 Sheffield Ave., Brooklyn, N. Y. This ornamental design for a bathing cap shows an article round topped and somewhat high with a fluted band around the bottom, and above this a bow and in front a rosette with a large button in the center.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write to us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. In every case it is necessary to give the number of the inquiry. Where manufacturers do not respond promptly the inquiry may be repeated.

Munn & Co., Inc.

Inquiry No. 9301. Wanted the names and addresses of a few concerns who can do machine embroidery according to the design furnished at reasonable rates.

Inquiry No. 9302. Wanted the address of the manufacturers of the Greenfield flexible armored conductors or cables. This is a double galvanized spiral conductor or cable.

Inquiry No. 9303. Wanted the name of manufacturer who could make newly patented articles made from 18 to 20 gage sheet aluminum.

Inquiry No. 9304. Wanted the names and addresses of manufacturers of a second hand rug cleaning machine on the order of a carpet cleaning machine.

Inquiry No. 9305. Wanted the name and address of concerns making paper letters and figures.

Inquiry No. 9306. Wanted small hardware and other specialties to be sold in notion and grocery stores. Wanted to buy wholesale.

Inquiry No. 9307. Wanted to buy a machine for honing and stropping safety razor blades on a commercial scale.

Inquiry No. 9308. Wanted woven wire fabric for [illegible] purposes [illegible]

Inquiry No. 9309. Wanted to buy small [illegible] for use [illegible] around the [illegible]

Inquiry No. 9310. Wanted addresses of [illegible]

Inquiry No. 9311. Wanted [illegible]

[illegible]

The Gasoline and Kerosene Situation

THE invention and perfection of the gasoline motor and its application to the automobile and power boat dates back to the high speed gasoline engine of Gottlieb Daimler as shown at the historic Mackay Bennett automobile race from Paris to Bordeaux. Europe gives Daimler full credit for his work by remembering him as the "Father of the Automobile."

The introduction of the Daimler motor opened up an entirely new market for the lighter oils, gasoline and naphtha, which developed within the short period of ten years into larger proportions than the most optimistic oil men ever dreamed of. Under these conditions the inexorable law of supply and demand brought about a price level for the volatile distillates far in excess of former values.

For nearly half a century price advances were extremely moderate, as the fluctuating market quotations of gasoline were ordinarily within narrow limits. An approximate general statement would be that the mean increase in price, barring fluctuations, was about one mill per annum per gallon—equalling one cent per decade. The total sum of these price increments had brought gasoline from, say, 5 cents up to 10 cents per gallon in tank car lots at the close of 1911.

But last year an unparalleled increase of 6 cents raised the wholesale price to 16 cents per gallon at the close of the year. In 1912 the wholesale price therefore advanced 60 per cent, and the retail price about 75 per cent.

Furthermore, it should be noted that the low cost gasoline of the early days varied in gravity from 70 deg. to 76 deg. Baumé, averaging 72 degrees or 73 degrees, while the gasoline now marketed is about 10 degrees lower. This 62 degrees or 64 degrees product was formerly sold under the trade name of benzine.

United States Government reports show that the advancing price of gasoline is due solely to inevasible laws of supply and demand. No corporation or combination of corporations is responsible for the fact that demand has overtaken production and that further increases in prices are now impending.

American gasoline and naphtha were formerly obtained solely from high grade paraffine crudes of Pennsylvania and Ohio. These are the most valuable oils in the world, and highest grade Pennsylvania crude now actually brings the same price as refined kerosene in bulk.

But unfortunately Pennsylvania production has fallen from 33,000,000 barrels in 1891 to about 9,000,000 barrels at the present time. However, at present prices even this decreased production represents over $18,000,000.

Ohio has decreased in production from 24,000,000 barrels in 1896 to less than 9,000,000 barrels during the year last past. Again, the zenith production of our own State of Indiana was in 1904—over 11,000,000 barrels—but the present yield shows a shrinkage of nearly 90 per cent from maximum.

"The United States Geological Survey states that the general decline in production would doubtless have been much greater but for the effort to apply laws of supply and demand by increases of prices. Prices advanced so greatly during the year as to stimulate drilling even in the old New York and Pennsylvania pools, and so checked the decline. Formerly this plan has not been so successful. In the mid-continent field also it checked the decline so that the product will come within 4,000,000 barrels of the maximum output."

Canada, also, has fallen off one third from her highest production of five years ago, and the only new field in sight is Tampico in Mexico, which has grown from nothing three years ago to 6,000,000 barrels in 1912.

About the only home fields not showing decreased output are in California and Oklahoma. Three fifths of the total yield now comes from these two States. And even the increased output of Oklahoma was insufficient to provide a continuous

reduction of stock on hand in 1912. Ninety per cent of the entire output of more than 220,000,000 barrels were crudes which yield a very low percentage of gasoline.

The following market prices of eastern mid-continent, and western crudes are fairly indicative of their relative gasoline content.

Pennsylvania	$2.05 per bbl.
Indiana	1.23 per bbl
Oklahoma and Kansas	.83 per bbl
California	.35 per bbl.

These prices of crude oil were correct as of January 25th, 1913. Since that time Pennsylvania crude oil advanced 7 cents a barrel on each of three successive days, standing now at $2.50, and three-dollar oil is freely predicted.

In order to obtain a single gallon of gasoline from refinable California petroleum, it is necessary to produce as by products nine gallons of kerosene and thirty gallons of residual oils. Notwithstanding the steadily increasing output of western oil the price of gasoline on the coast continues to advance. It is now 30 cents per gallon at retail

Large shipments of Texas oil formerly came to the Atlantic seaboard in tank steamers, but these shipments have decreased as the Texas oil yield is now less than one third its 1905 output. In view of the Texas shrinkage it is obvious that the opening of the Panama Canal will furnish a large eastern market for California oil, but it is equally obvious that under existing conditions that will not materially affect the gasoline situation.

There are five different methods of increasing the normal visible supply of gasoline.

One is importation. The Standard Oil Company has imported some Russian naphtha, but Russia has no more to spare as her own oil output is diminishing to such an extent as to increase the price 100 per cent in the last two years, and to warrant the Russian government in the promotion of alcohol production The Shell Oil Company of England has also shipped some gasoline from Borneo to Canada, but the total quantity available abroad is insufficient for its home demands and America is still exporting gasoline to foreign markets at the rate of fifteen to twenty million gallons per month

Another and more promising means of obtaining gasoline is by increasing the total yield of American crudes. A yearly production of 300,000,000 barrels in the United States is probably being approached faster than even oil men generally believe But the largest increase in the production of gasoline in one year has never been more than 5 per cent, while the production of power-driven vehicles will in all probabilities represent an increase this year of around 100 per cent. Furthermore as already shown, the supply of gasoline-yielding crudes is rapidly decreasing and the increased crude output will consist of Oklahoma and California asphalt oils, having insufficient gasoline for existing requirements.

The third means of supplementing the gasoline supply is the production of gasoline from kerosene. Chemists have known for some time that it was entirely feasible to extract gasoline from the chemically complex kerosene, as well as from coal, coal tar, and even wood. It is simply a question of cost, and of the profitable disposal of resultant by products. Gasoline is now being made from kerosene, and a further increase in price will stimulate an increased output.

A fourth source of gasoline supply is its manufacture from natural gas by compression, and its subsequent condensation to a liquid form. It is claimed that this process produced 13,000 gallons in 1910, which was increased to 50,000 gallons in 1911 and about twice as much in 1912. Some of the richer gases produce as much as 8 gallons per 1,000 cubic feet, but the average is from 3 to 5½ gallons. By triple and quadruple compression up to pressures as high as 400 pounds, very light liquids up to 85 deg. Baumé are produced, these being slightly more stable

than the products of fractional distillation.

The fifth and last means of increasing the available gasoline supply is by lowering its Baumé gravity. It is probable that the specific gravity of commercial gasoline will be dropped another notch by next summer Much of the liquined-gas gasoline is used for blending with heavier distillates, and it naturally requires other than gravity tests to determine the characteristics of such blended gasolines.

With the exception of importation these various methods of augmenting the available quantity of gasoline are now in active operation, and every increase in price is a stimulus to additional output.

This brief review of market conditions shows that the problem of an adequate supply greatly overshadows the collateral problem of the increasing cost of gasoline.

Fortunately we have two alternative liquid fuels immodiately obtainable. Alcohol and kerosene oil offer an ample supply of satisfactory fuel to the power-driven vehicle. We need not discuss alcohol at this time, further than to point out that it is a very good fuel and can be used advantageously if gasoline advances to 20 or 25 cents wholesale In fact there is no valid reason why alcohol should not be used to-day in cars selling around $5,000. Of course, special engines with appropriate compression are required, as gasoline engines are not adapted for alcohol.

Predictions heretofore made in regard to denatured alcohol as a fuel have not yet materialized Nevertheless, it is probable that alcohol alone could hold down the price level of gasoline from advancing appreciably beyond 25 cents to 30 cents in tank car lots

But the one best fuel is oil

Oil combines more advantages than any other It is the fuel of the future and the fuel of to-day In comparison with gasoline or alcohol it is much cheaper safe, better adapted for shipment, more uniform in quality, more highly concentrated, more powerful, and above all, more abundant in all localities.

Even in tho far distant future, when the crude oil output falls below the world's demand for liquid fuel, a practically unlimited source of oil will be the great oil bearing shales which cannot be worked profitably at the present low price of kerosene

After many years of observation and experience I am convinced that as a medium for generating power for transportation, on land or water, mineral oil or kerosene is the most valuable general purpose fuel known to commerce. This statement is made in full recognition of the fact that the oil engine has always had less commercial popularity than either the gas or the gasoline engine

In former days the oil engine was heavily handicapped by the high price of both crude and refined oil Gasoline was then a by product selling at 5 cents or even less. But the lapse of time has completely reversed the market relations of gasoline and oil. Oil production is in excess of consumption. Kerosene is now the by-product and is quoted at 60 per cent less than gasoline.

[*From an address delivered by John A Secor before the Society of Automobile Engineers (Indiana Section) at the Claypool Hotel, Indianapolis, February 18th, 1913*]

Determines the Butter Fat in Butter and Dedicates Patent to Public.—By a method patented by Roscoe H Shaw of Washington, D C, No. 1,052,098, it is sought to determine the fat content of butter by placing the buttter in a container with hot water, then centrifuging the solution, removing the aqueous solution from the container and adding thereto an equal mixture of sulfuric acid and water, when the contents are again centrifuged and the acid solution is partly drawn off. After this the contents are subjected to a second centrifuging and the container and butter fat are weighed. This patent has been dedicated by the inventor to the public.

NEW BOOKS, ETC.

HEROES OF SCIENCE An Account of the Lives, Sacrifices, Successes, and Failures of Some of the Greatest Scientists in the World's History By Charles R. Gibson, F.R.S.E With 19 illustrations. London Seeley Service & Co, Ltd, 1913

Mr Gibson has written a book in which he reveals to us the romantic and the tragic side of science an essentially human book which is frankly intended for popular reading, and which will do much to remove the foolish impression that men of science are bloodless Among the more conspicuous figures that play a part in this volume are Roger Bacon Copernicus Tycho Kepler Galileo Newton Franklin Priestley Cavendish William and Caroline Herschel Dalton Sir Humphry Davy Darwin Kelvin and Maxwell

THE INFANCY OF ANIMALS By W P Pycraft Zoological Department of the British Museum Fellow of the Zoological Society of London etc With 64 plates and numerous illustrations in the text New York Henry Holt & Co, 1913

While purely a descriptive work and written entirely along zoological lines Mr Pycraft's volume will be read chiefly by the amateur student of animal life seeking to learn some of the elements of zoology No attempt is made at a biological interpretation of early animal development nor to fit the facts recorded into current biological theory For that reason some may be inclined to regard the book as a little old fashioned For all that one cannot help feeling that Mr Pycraft has given us a very well written interesting and instructive book on a phase of animal existence on which very little of a popular character is to be found

DIE ELEKTRISCHEN EINRICHTUNGEN DER EISENBAHNEN (The Electrical Auxiliary Installations of Railways) A guide for the self taught student of the telephone telegraph and electrical signal installations of railways By R Bauer, A Prasch and O Wehr Third revised edition Vienna A Hartleben 1913 432 pp Price 6 marks

The book before us is intended for the use of those who wish to obtain a knowledge of the electrical auxiliary installations employed in railroad service and who have not a very extensive special training in electricity But the book really serves more than this purpose and forms a very useful reference book on a subject on which comprehensive information is not readily obtained in other sources. The book is divided into five sections. The first is introductory and in 68 pages of text presents the fundamental principles of electricity and magnetism The second section is devoted to the telegraph the third to electrical railway signals the fourth to telephony and the fifth to the general manipulation of the various forms of apparatus employed and to the discussion of various disorders and breakdowns which are apt to occur

Both authors and publishers have done their work very excellently in the preparation of this book Works of this character are somewhat scarce and for this reason particularly valuable. We would like to see an edition of this book in the English language so that it might be made accessible to a larger number of our readers

THE STOCK EXCHANGE FROM WITHIN By W C Van Antwerp Garden City New York Doubleday Page & Co 1913 8vo 459 pp illustrated Price $1 50 net

The work is an explanation and to some extent an exoneration of the Stock Exchange and its methods by one of its own members Inasmuch as the author demonstrates the necessity of a stock exchange familiarizing the reader with all phases of its utility and with the routine of its transactions and its every-day life the book fills a distinct hiatus in the literature of American business

NOTES ON SAMPLING AND TESTING The Handbook of the Manchester Chamber of Commerce Testing House and Laboratory Manchester England Marsden & Co, Ltd 1913 8vo 90 pp, illustrated

CHAMP CLARK By W L Webb New York The Neale Publishing Company, 1912 8vo 256 pp; illustrated Price, $1 net

FIRST YEAR ALGEBRA By Webster Wells, S B and Walter W Hart A.B New York D C Heath & Co, 1912

DIRECTORY OF CEMENT GYPSUM AND LIME MANUFACTURERS Seventh edition Chicago The Cement Era 1913 Price $1

WIRELESS TELEGRAPHY SIMPLY EXPLAINED By H T Davidge, B.Sc M I E E New York Spon & Chamberlain Price 25 cents

BUDDHISM A Study of the Buddhist Norm By Mrs. Rhys Davids, M.A New York Henry Holt & Co 16mo, 255 pp Price, 50 cents net; by mail, 56 cents

BEAUTY OF THE HIGHEST TYPE A Scientific and an Artistic Aim for a Nobler Beauty By Carolina Williams LeFavre. New York The Health Culture Company, 1913.

THE ORIGIN AND NATURE OF LIFE By Benjamin Moore, M.A., ... New York, Henry Holt & Co. ... 256 pp. Price, 50 cents net.

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given *on every sheet*. *No attention will be paid to unsigned queries*. Full hints to correspondents are printed from time to time and will be mailed on request.

(12798) H. M. S. asks: A sketch intended to represent a voltaic cell is sent. This sketch was taken from the notebook of a high-school chemistry pupil who copied it from the blackboard. I have no definite information as to what explanation the teacher gave in connection with it, but he evidently taught that the poles are charged with one kind of electricity below the surface of the liquid and with the opposite sign above the electrolyte. Is this correct? If not, can you explain how the error arose? A. The sketch of a voltaic cell which you send gives the old idea. Carhart's "Primary Batteries," published in 1891, on page 18 gives the sketch as you show it. Carhart's "College Physics," published in 1910, gives the accepted theory of ionization and the travel of ions to account for the potential set up in a cell. We send the book for $2.50 postpaid. If sulphuric acid is the electrolyte, positive hydrogen ions are constantly traveling to the copper plate and negative sulphions toward the zinc plate, where they take away zinc to form zinc sulphate, and the zinc becomes negatively charged both within and without the liquid. The hydrogen ions give up their positive charge to the copper, become hydrogen gas, and rise out of the cell, or else polarize it unless otherwise disposed of. The only suggestion we can make to account for the use of this old theory is that the teacher of chemistry who used it had not kept up with the advance in theory in his own subject. Perhaps he had too many subjects to teach and was overloaded. There are many such in high schools who should be pitied rather than blamed.

(12799) R. G. asks: 1. I should like to know if you can tell me if there is any known substance that will carry a current of magnetism but will resist a current of electricity? A. Magnetism acts by what we call lines of force, and these pass from one pole of a magnet through the air or other material to the other pole. All substances allow these lines to pass through them with about the same ease excepting iron, which allows them to pass with greater ease than do other substances. There is no current of magnetism in the same sense as there is a current of electricity. 2. Will lodestone conduct an electric current? Does a piece of lodestone have north and south poles the same as any other permanent magnet? A. Lodestone is an oxide of iron and is not a conductor of electricity. A lodestone has a north and a south pole like any other magnet, and if it is hung up so that it can swing it will come to rest with its poles in the north and south line.

(12800) W. H. K. asks: Can a building, having a tin roof with a spout entering the ground, be struck by lightning? A. A building having a tin roof well grounded can be struck by lightning just as any building not protected at all may be, but it is not so likely to be injured by lightning. You would do well to get the Farmer's Bulletin No. 367, "Lightning and Lightning Conductors," and see the most sensible method of protecting buildings which we have seen. We think the price is fifteen cents in coin or postal order sent to the Superintendent of Documents, Government Printing Office, Washington, D. C. This document discusses the protection of buildings with metallic roofs.

(12801) T. J. L. asks: If a steam whistle of a certain pitch be moving from a hearer at a high velocity the sound will be heard in a lower pitch than if both whistle and hearer were stationary; in fact, if the whistle were moving from the hearer at something near the velocity of sound it could not be heard at all. Would not the same be true of light? Heat and light being solar energy of different wave length, it seems to me that if a luminous body, say a star, be moving toward us at an enormous velocity or from us at the same velocity, the heat waves might become light waves and the light waves heat waves, that is, to the observer. Could this explain the phenomenon of the "variable star"? Such a motion would be possible if the orbit of the star were seen, so to speak, from the edge. I don't know whether so high a velocity could be possible. A. The principle which you state as applying to sound emitted by a moving body is called "Doppler's principle," and applies to light from a moving source of light in the same manner as it does to sound. By measurements with the spectroscope it is possible to determine the velocity of motion of stars toward or from the earth or of the opposite sides of the sun or a sun spot. You will find this matter discussed in textbooks of astronomy. We can furnish you with Young's "Manual of Astronomy" for $2.50. No body has been found with a velocity anywhere approaching the speed of light. Heat waves would become light waves if sufficiently accelerated. The relative velocities of double stars have been determined by this method, even when the separate components can not be seen with the highest powers of the telescope. These are called spectroscopic binaries.

(12802) C. E. D. asks: In your Notes and Queries, 12760, you say that gravitation differs from other great forces of nature, and "acts instantly, not flowing with a velocity which would require time for it to cover a space." This I am unable to square with my reason. If gravitation did not require time, then its speed, which you term "instantly," must be infinite, and any force propagated by an infinite speed becomes inconceivable. It seems to me much more probable that gravitation has a speed just as light or electricity, but we simply have not found a means of measuring it. Light, for example, acts instantaneously so far as most of us are concerned, but we know that it has a speed and is not instantaneous. Why should we assume that gravitation is otherwise? Much more could be said on this subject, but I will be pleased to hear your reply to the above. A. The inference that gravitation acts instantaneously between the earth and the sun is based upon a simple fact that the force between the earth and the sun which we call gravitation is directed from the center of the earth to the center of the sun. If the speed of gravitation were that of light, for example, the earth at a speed of 19 miles a second would travel over more than its own diameter before the attraction would reach it and would be farther from the sun than it was when the force started from the sun. The earth would under this hypothesis soon escape from the sun's control. On this point we quote the Encyclopedia Britannica, under the word "Gravitation," vol. xii, page 384b: "The question has also been raised whether the action of gravitation is absolutely instantaneous. If not, the action would not be exactly in the line adjoining the two bodies at the instant, but would be affected by the motion of the line joining them during the time required by the force to pass from one body to the other. The result of this would be seen in the motions of the planets around the sun, but the most refined observation shows no such effect." We think we may rest upon this authority. At any rate, all astronomers consider that gravitation acts across the spaces instantaneously. We may add that gravitation gives no evidence whatever that it is a wave motion as light is, nor does it give any indication whatever as to its intrinsic nature. It is one of the deepest of mysteries.

(12803) A. D. H. asks: By electrically welding two pieces of steel wire together it is claimed that the wire is injured at the joint. Does this electric welding process have a tendency to harden the steel, burn the wire or make it brittle at the joint, or injure the wire at the joint in any way? Why do the wires break more easily at the joint? A. To weld a piano wire with electricity it is necessary to heat the wire till it is very soft. This will certainly draw the temper. It will also burn out some of the carbon and greatly reduce the quality of the steel. Both changes will weaken the wire.

(12804) C. L. J. writes: From observations on numbers of cables in different parts of the world I have found the greater the angle of direction from north and south, the greater have been the earth currents in them. The E. M. F. of the currents varies considerably, averaging generally 2 or 3 volts in cables running east and west. On one occasion, some years ago, between India and the Malay Peninsula, the E. M. F. measured nearly 100 volts, but this was exceptional and due to magnetic disturbances in the atmosphere. I have never seen it advanced in any textbook, but it has been my opinion that the compass simply follows the well known fact that a magnetized needle places itself at right angles to any electrical current in its neighborhood and does not obtain its direction from its attraction by what we know as magnetism. I am also of opinion that a magnetized needle or compass would *not* point directly to the earth as you state, and at the true magnetic pole it would have no definite direction. A. Those interested in the subject of "earth currents" will find quite an elaborate article upon them in the Ency. Brit., eleventh edition, vol. viii, pages 811-816. It gives also a bibliography of the subject, although this is not at all complete. There seems to be no doubt that the earth currents are connected with the earth's magnetism, but it can hardly be decided as yet which is cause and which is effect. The maximum voltage observed was in 1859, when as high as 700 to 800 volts were found on telegraph lines 400 to 475 miles long. Earth current voltages as high as half a volt per mile have since been found, but these are exceptional. They appear to be connected with sunspots and magnetic storms. They may well be believed to cause the magnetic lines of the earth to which the needle of the compass places itself parallel. Every wire carrying a current of electricity is surrounded by whirls of magnetic lines of force, and the compass needle places itself parallel to them, thus taking its position across the wire, but the needle is thought of as following the lines of force and not as standing across the current of electricity. The behavior of the dipping needle follows the same rule. A well-balanced needle is hung upon a horizontal axis. If magnetized and placed in a north and south line, with its axis east and west, it will come to rest in the northern hemisphere with its north pole below the horizontal and the south pole raised. In New York the dip is about 70 degrees. Over the magnetic pole the dip is 90 degrees, that is, the dipping needle stands vertically, or straight up and down. It is in this way that the magnetic poles are located, and we have no other means of locating them. The dip needle places itself tangent to the lines of force in the place where it is. An ordinary compass with a needle swinging horizontally will not indicate the magnetic pole, because it will over the pole have no directive force at all, and will point indifferently in any direction.

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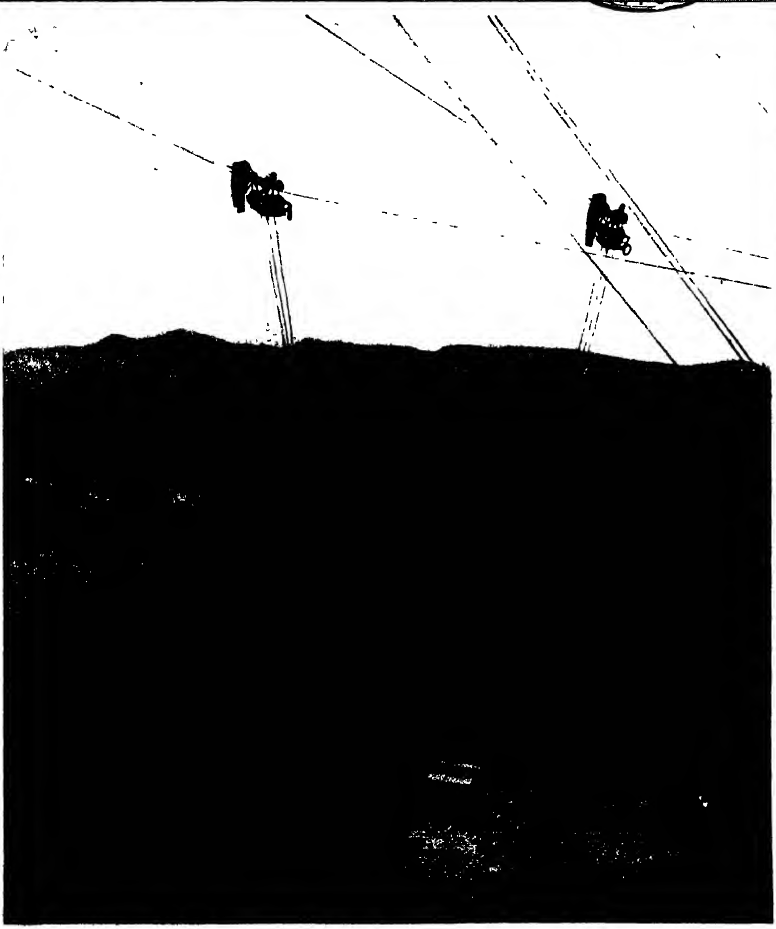

A twenty-ton dinkey engine carried across the canyon at Elephant Butte, New Mexico, where a dam is being built across the Rio Grande River

TRANSPORTING A LOCOMOTIVE ON A CABLEWAY.—[See page 470.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are *sharp*, the articles *short* and the facts *authentic* the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

Shall We Retard, Divert, or Confine Our Flood Waters?

EVER since our issue of May 3rd in which we devoted considerable space to the control of the Mississippi River, the Editor of the SCIENTIFIC AMERICAN has been receiving quantities of letters on this most important subject, which was to be expected when we reflect that the drainage area of the Mississippi system involves about two fifths of the country However while many of the letters have been highly appreciative, others have called us to account for championing the levee system and for not favoring this or that bill introduced before Congress. The Editor has a collection of these bills before him About a dozen have been introduced before the present session, most of them however being of little importance for the reason that they call for local appropriations.

But the particular bill which has figured conspicuously in most of the letters is one that was introduced by Senator Newlands before the last session of Congress This provides for the creation of a Board of River Regulation, an appropriation of fifty million dollars annually for ten years to be used in overcoming the floods of the Mississippi and the Sacramento and San Joaquin rivers, and for co-operation between the Government bureaus and States, municipalities and local agencies

We have no fault to find with the broad purpose of this bill There isn't a shadow of doubt that the control of the Mississippi River with its *great* tributaries is a national problem A large majority of the States of the Union contribute in whole or in part to the enormous floods that pour down through the Mississippi Valley We thoroughly believe in co-operation between State and Federal authorities in the control of these floods and heartily endorse that section of the bill which aims to secure financial co-operation of States to an extent at least equal in amount to the sum expended by the Federal Government Only by co-operation can such an enormously large water course be regulated

Nevertheless, the SCIENTIFIC AMERICAN must take exception to certain provisions in the bill which although made in good faith, clearly indicate that the framer of the bill had no adequate conception of the vastness of the subject he was dealing with

Col Townsend's paper, published in the SCIENTIFIC AMERICAN SUPPLEMENT of May 3rd discussed this matter at length He showed that in order to hold back five hundred thousand cubic feet of water per second it would be necessary to reforest a territory equal to one sixth of the area of the United States. Furthermore it would take a hundred years for such a forest to grow and shed enough leaves to form the spongy humus necessary to retain this amount of moisture

The reservoir idea put forth in the bill is also based on a popular misconception of the vast amount of water that flows down the Mississippi system It is usually contended that the reservoirs could be made to pay for themselves owing to the amount of hydro-electric power that could be generated by the use of their waters. But in order to obtain a working head such reservoirs would have to be placed near the headwaters of the rivers and tributaries where they would be of little service in taking care of the floods on the lower reaches. It has been demonstrated conclusively that a reservoir will only regulate the flow of the river in its immediate vicinity, but will have very little effect on points a hundred miles or so farther down stream Col Townsend has shown that if a reservoir were placed near Cairo, Ill, it would have to cover something like seven thousand square miles and would have to be excavated to a depth of fifteen feet in order to take care of the water that rises above the normal banks of the river This would involve an excavation nearly five hundred times as great as that of the Panama Canal.

The SCIENTIFIC AMERICAN believes in reforestation. Our woodlands ought to be extended. The timber is badly needed We favor the construction of artificial reservoirs wherever possible With the increasing demands on our steadily diminishing coal supply, we shall have to turn to hydro-electric development We favor swamp reclamation and the building of drainage and irrigation systems where needed But what has all this to do with the control of the Mississippi? We cannot encourage the false hope that any of these schemes, taken singly or collectively, will have any material effect on the enormous torrents of water which pour down the Mississippi Valley

A bill was introduced before the House of Representatives a few weeks ago, which purports to provide an entirely new solution of the Mississippi problem. It calls for the purchase by the Government of a strip of territory ten miles wide running parallel to the Mississippi to the west, this strip to be extended eventually from the Gulf to Cairo, Ill Along each edge of this ten mile strip a levee is to be built, and into the channel thus formed, the flood waters of the Mississippi are to be diverted, providing them with a new outlet to the Gulf The idea is far from new Thirty years ago the outlet system of the control of the Mississippi was widely discussed and condemned largely because of the fear that the Mississippi might take the notion to change its course completely and leaving the cities along its banks high and dry It was proposed at that time to connect the Mississippi with the Atchafalaya River and allow this to take off the surplus waters. The fear of such a sudden diversion of the main channel on the Mississippi led to the construction of ground sills in the Atchafalaya at various intervals. These consisted of large willow mats weighted with stones and sunk to the bottom the idea being that they would retard any scouring that might result from the increased volume of water pouring down the Atchafalaya This done it was considered safe to let the overflow of the Mississippi run into the Atchafalaya which it does at the present time The ground sills are still in place and they have successfully prevented the Atchafalaya from being scoured out to such a depth as to change the course of the Mississippi

It is the purpose of the present bill before Congress to provide an Atchafalaya ten miles wide, so that the Mississippi River could never rise to anything like its present flood levels, but the promoters of this bill do not seem to realize that a channel such as this would fill with sediment, if the current were not swift enough to carry the material on down to the Gulf and if it were made swift enough might not the river take the bit in its teeth and run down the new channel instead of the old? The Mississippi problem would not be half so difficult if it did not carry so large a percentage of sand. But why discuss this proposition? Would not the cost of purchasing a ten mile strip along the Atchafalaya be practically prohibitive? Would it not call for the building and maintenance of double the present levee system? And then what advantages would it have over the present system, in which large areas are occasionally flooded? Why not condemn the present flooded areas and be done with it? However hasn't the levee system already vindicated itself? This year there have been only two serious breaks, one at Meyersville Miss., and the other near Lake St John Louisiana But the rest of the hundreds of miles of levees stood up well. Apparently to control the lower Mississippi it is merely necessary to make our levees higher and stronger The fear that the bed of the river is being raised by the levees is groundless. It has been conclusively proven, not only in the investigation of the Mississippi River, but in that of many rivers abroad, that levees do not tend to raise the bed of the river to any appreciable extent The Mississippi River bed is estimated to be one tenth of a foot higher this year than it was a hundred years ago. The present high-water readings merely indicate that the levees are doing their work better by confining the river to its course, and we must continue to build them stronger and higher until they are capable of taking care of the maximum flood. Any other form of control is hopelessly inadequate.

Personal Error and Efficiency Engineering

IT is the part of the scientific man to discover the truths of nature. But as there is nothing absolute, all his observations are necessarily more or less vitiated by errors. It is not enough for him to reduce these errors to a minimum. He must assure himself that he knows their nature, the order of their magnitude, and their influence upon the conclusions and operations which he bases upon his observations. All these points have received due attention, and a fairly complete "theory of errors" thus developed forms part of the stock-in-trade of every worker in the exact sciences.

But scientific observation and manipulation is merely a refinement of common every-day practice, and errors of observation and of operation play an important rôle in our daily pursuits also. How much a man's earning capacity and even life depends upon the perfect working of his senses and limbs is often not realized by him until age, illness or accident has impaired it. Not only is there such a qualitative relation between a man's physical and mental well-being and his earning power, but accident and life insurance companies, as well as courts in deciding actions for personal injury, find themselves confronted with the problem of establishing some quantitative estimate, however crude, of the value of a man's organs, their influence upon his earning capacity or "efficiency"

It would be a poor policy that should take note only of the value of lost faculties. To the efficiency engineer more than to any other person we owe it that our attention has been drawn to what might be termed "false motions," i. e., errors of operations, and their influence upon the efficiency of the industrial worker under normal conditions. And not merely qualitative, but quantitative studies, made with watch and camera, have furnished us a truly scientific groundwork on which to base improved manufacturing methods, to secure greatly increased efficiency It is sometimes falsely supposed that the additional output thus harvested is the result of increased pressure placed upon the worker If instances of this kind have occurred, they are contrary to the purpose which the originators of the movement for increased efficiency had in view: the output is to be increased, not by increasing the pressure of work, but by decreasing the resistance, by eliminating waste in lost motion and misplaced energy Such increase in the output *must* result on the whole in a gain to the entire community, perhaps not always in a gain evenly distributed among all members of a community, but nevertheless, in a gain to all

The International Magnetic Survey

SEVERAL features of the remarkable work carried on by the Department of Terrestrial Magnetism of the Carnegie Institution—as, for example, the construction and the cruises of the non-magnetic yacht "Carnegie"—have attracted general attention, and have been extensively written up in the popular as well as the scientific press. On the other hand, persons who actually have occasion to use magnetic data, for either scientific or practical purposes, have been wondering how soon the institution in question would put the results of its vast undertaking into statistical or cartographical form for the benefit of the world

There has now been published the first volume of a series under the general title "Researches of the Department of Terrestrial Magnetism," in which all the results of the department's work will be collected as fast as possible The initial volume is entitled "Land Magnetic Observations, 1905-1910" and is Carnegie Institution Publication No. 175. Future volumes will contain the results of the work on land subsequent to 1910, of the cruises of the 'Galilee,' 1905-08 and the work done on the "Carnegie" from 1910 onward. While these publications will deal chiefly with terrestrial magnetism, they will also contain occasional memoirs on atmospheric electricity and other subsidiary subjects.

The Department of Research in Terrestrial Magnetism—to give it its full title—was founded April 1st, 1904, its principal object being to secure data for a general magnetic survey of the globe. Under this general head its work is twofold comprising the correlation and consolidation of the national and local magnetic surveys already under way in various parts of the world, and the execution by the department itself of magnetic surveys where none have been undertaken. The latter part of the programme involves a good deal of downright exploration in little-known lands and over untraveled seas. The volume now before us, which deals entirely with observations made on land, is illustrated with photographs, abounding in local color, showing field stations all the way "from China to Peru." It should be explained that such photographs are not merely ornamental, but serve the practical purpose of identifying the exact location of the stations, so that they may be reoccupied at any future time for the purpose of making comparative observations. No less interesting than these photographs are the narratives of the journeys made by the various observers, often bristling with adventure. Of course, the substantial part of the volume is the tabulation of the observations.

A full account is given of the instrumental equipment and methods of reduction. It is explained that the publication of the results contained in the present and subsequent volumes has been delayed by the many problems presented when magnetic observations made over the greater part of the globe are to be published on a uniform basis.

Electricity

The Electrical Export Figures for March have just been published by the Bureau of Foreign and Domestic Commerce. They show a remarkable increase over the figures for March, 1912. The total for the month this year was $2,489,374, whereas for the corresponding month last year the total shipments amount to $1,833,-680. The total for nine months ending with March is $19,348,066 as against $14,573,898 last year

Charging Stations for Electric Vehicles.—The New York Electric Vehicle Association has just issued a handbook for the users of electric automobiles. It contains a list of charging stations in the city of New York, on Long Island, up the State as far as Hudson, east as far as New Haven, west as far as Easton and south to Philadelphia and Atlantic City The handbook also contains a chapter on the care of both lead and nickel-iron batteries

The Largest Turbo-generator in the World is being built for the Commonwealth Edison Company of Chicago, by the General Electric Company It is of the horizontal turbine type and will generate 30,000 kilowatts. The over-all length of the machine will be 60.5 feet and it will be 18 feet 4 inches wide by 14 feet high It will run at 1,500 revolutions per minute The generator will be a 25-cycle, 3-phase machine with two poles, and the output will be 1,925 amperes per phase with a voltage of 9,000. The total weight of the turbine and generator combined will be about a million pounds.

Wireless in Canada.—At Le Pas, Manitoba, the southern terminus of the Hudson Bay railway, there will soon be erected the second largest wireless station in Canada. It will include four 250-foot steel towers and will cost about $100,000 Plans are under discussion for establishing several wireless stations in the far Northwest, viz., from Athabasca Landing up the Mackenzie River to Herschel Island, in the Arctic Ocean, and from there to Rampart House, in the Yukon. Such stations would be valuable for scientific purposes, especially for collecting meteorological reports, and would also be serviceable to the Northwest mounted police

Non-absorbent Slot Insulation in Motors.—A motor used in tropical climates is apt to develop defects which do not appear under other conditions, for the reason that it is subjected to high temperatures and a great deal of moisture It has been found that the absorbent insulation used in the slots in stators is responsible for a good deal of trouble Where this weakness has developed the motors have been rewound with micanite insulation and this has cured the trouble A similar condition of affairs might result even in temperate zones, where the motor is situated in a damp place subject to high temperatures. In such position it is advisable to use a non-absorbent slot insulation

Indirect Street Lighting.—We have been taught to appreciate the advantages of indirect, direct-indirect and semi-direct lighting over the dazzling illumination and injurious glare of naked lamps But so far these improvements have been applied only to interior lighting Our streets are still lighted by direct illumination Could not indirect lighting be employed here too? It certainly would be preferable to have a street lighted throughout its length by a soft evenly distributed light in place of the present system of bright spots with jet-black spaces intervening At a recent meeting of the Illuminating Engineering Society of Great Britain, J Darch suggested that streets could be illuminated in this way by casting the light against housefronts from which it would be reflected to the street again In this way the glare of the lamp would be overcome Objections to such a system immediately present themselves. It would be difficult to place the lamps in such a way that the glare would not be objectionable to the occupants of the building while using at the same time a reflecting area sufficiently large to provide efficient illumination.

Platinum Terminals for Quartz-tube Mercury-arc Lamps.—In order to obtain higher efficiency and better light values from mercury arc lamps, it has been the practice to substitute quartz tubes for glass, and to operate the lamps at higher voltages and consequently higher temperatures. One of the principal difficulties encountered has been that of sealing in the terminals of the lamps. The co-efficient of expansion of quartz is 0.5×10^{-6} and that of platinum is 9×10^{-6} This great difference of expansion has made it necessary to employ some other metal Now tungsten with a co-efficient expansion of 3.5×10^{-6} is being used. The difference of the co-efficient expansion is such that the tungsten can not be sealed directly in the quartz, but instead is sealed in a boro-silicate glass of the same co-efficient of expansion and of a high melting point, while between this seal and the quartz tubes a number of glasses of varying co-efficient of expansion are used, providing what is known as a "graded seal." It has been suggested that this method of introducing electrodes into a bulb could also be used in connection with ordinary incandescent lamps. If so, it would materially reduce the heavy demands of the electrical industries on the expensive and precious metal platinum.

Science

The Willard Gibbs Medal Presented to Dr L. H. Baekeland.—On Friday, May 16th, the Willard Gibbs medal was presented to Dr L. H. Baekeland by the Chicago Section of the American Chemical Society

A Magicians' Club has been founded in London and has just opened its clubhouse The membership comprises more than 200 professional and amateur conjurers. The clubhouse will include a museum of magic a library of some 500 technical works on conjuring, and an experimental room with appliances for making new tricks

The Time Service of the U S. Naval Observatory has become much more generally useful than heretofore through its transmission by radio-telegraphy, especially since the opening of the great wireless station at Arlington The noon signal has been transmitted by radiotelegraphy to ships at sea since January, 1905, and it is believed that this observatory was the first by over two years to have its time regularly transmitted in this way The utility of the service on land is illustrated by the fact that thousands of jewelers are receiving or arranging to receive their time from the radio signals

The New Ministry of Agriculture and Forestry under the Chinese Republic will be extensively officered by young Chinamen who received their technical education in the United States Lai Kuei Liang, a 1908 graduate of the Massachusetts Agricultural College, has been appointed vice minister of agriculture and has begun the issue of the Chinese Agriculture Journal E L Hsieh, a 1909 graduate of the same institution, has charge of the translation of foreign agricultural literature into Chinese for this ministry, while H Jen, a classmate of Mr Hsieh, is director of the agricultural experiment station at Mukden, Manchuria.

Cellulose from Asparagus.—The American consul at Hamburg has reported the details of the process invented by Prof Otto Reinke for the recovery of cellulose from asparagus waste (from canning factories) and from the asparagus stalks that mature after the edible crop has been gathered Heretofore these residues have been practically worthless except as fertilizers, as they have but little nutritive value when used as fodder, and attempts to utilize them in making coarse paper or packing material have not resulted satisfactorily After undergoing a comparatively simple mechanical and chemical treatment they yield a beautiful pure cellulose, which may be used for bandages, blasting material, paper, tissues, fine felt, cardboard, etc

A Franco-British Scientific Congress—Special interest attaches to next year's meeting of the Association Française pour l'Avancement des Sciences, which is to be held at Havre, probably September 4th to 12th. A large number of British societies are to take part in the meeting There are 160 British societies affiliated with the British Association for the Advancement of Science, and it has been the custom for these societies to hold a conference in London whenever the association itself met in some far distant city—as in the case of the meetings at Winnipeg and in South Africa. (Strange to say the British Association has never met in London) Now it happens that in 1914 the British Association meets in Australia, and comparatively few members will be able to make the long and expensive journey, aside from those whose expenses are to be paid out of funds raised for this purpose in Australia. Accordingly, as Havre is comparatively near England, it has been decided to hold the conference of delegates from the affiliated societies at that place, in conjunction with the meeting of the French Association It is hoped that American scientific societies will also be represented at this joint meeting

The Greatest Wind Velocities are undoubtedly those occurring in tornadoes. The recent destructive storms of this class raise the question How high was the wind? but this question cannot be answered satisfactorily In the Annual Report of the Chief Signal Officer for 1875, p 435-436, there are some attempts to estimate the velocity of the wind in a tornado of that year from its more remarkable effects, e g, a pine board driven through a telegraph pole, another driven three inches into the trunk of a tree, and so on A velocity of wind sufficient to produce such results could not have been much less than that of a cannon-ball, or somewhere between six and eight hundred miles an hour It is doubtful whether we shall ever have instruments for measuring such winds, but on the other hand something might be done toward providing stronger instruments than those now in use, so that in winds of ordinary hurricane velocity the anemometer would not be carried away just when about to make its most interesting record The need of such an instrument is pointed out by Maxwell Hall, government meteorologist of Jamaica, in an account of the hurricane of last November in that island. A Robinson anemometer exposed to the hurricane of November 18th broke away when registering 120 miles an hour Probably the highest velocity ever recorded by an anemometer was 186 miles an hour, on Mt Washington, January 11th, 1878, but this and all other high records of anemometers (i. e., of the Robinson type) are well known to be greatly in excess of the true velocities.

Automobile

A Solid Pneumatically Cushioned Tire.—In a patent, No 1,059,115, Philip H Calmus of Birmingham, Ala., presents a vehicle tire having an outer solid rubber tire with recesses upon its inner side and an inflatable inner tube with integral air cushions which fit into the recesses in the solid rubber tire so that the solid tire protects the inner tube and the latter is held from motion relatively to the solid tire.

Testing Carbureters.—The Benz firm, the well-known automobile and internal combustion engine constructors of Mannheim, recently donated the sum of $12,500 with a view of starting a fund for installing a special laboratory for experiments upon carbureters for gasoline motors The laboratory is to be installed at the Hochschule of Karlsruhe In addition to this, it is stated that different subsidies have been collected for the purpose of founding a mechanical testing laboratory and shops at the same institution

Tire Makers Adverse to Tire Fillers—Whether or not there is any particular virtue in the various substitutes for air that have been developed and urged upon the public, the tire makers themselves do not take kindly to them at all As a matter of fact, they strongly advise against their use and have stated that guarantees will be rescinded if any other medium than air is used in their casings They give as their reason for the odium that has fallen on the tire fillers, the heat they generate and harbor and the deteriorating effect it has on the rubber

How Will Automobiles Be Improved?—It is difficult at this time, when automobiles have reached such a high degree of excellence, to indicate wherein improvements will be made In talking, however, with the writer, the owner of a medium-grade machine complains of the paint peeling off the metal body of his machine and expresses the belief that improvements will be made either in the paint itself or in the method of its application which will increase the durability of the painted surfaces upon the metal body of the machine At any rate, the field is a large one for inventors along this particular line

Kerosene Without Gasoline Priming—Despite the advances that have been made in the employment of kerosene for engines nominally constructed to burn gasoline, either preliminary heating or the use of gasoline is necessary for starting In order to afford a stimulus to inventors to overcome this difficulty, the Chambre Syndicale de l'Industrie du Petrole, of Paris, has decided to offer two prizes in connection with a proposed competition to discover the best means, if any means exist, to use kerosene without the necessity for using gasoline for starting purposes The prizes are $1,000 and $500, respectively

Storing Gasoline in Scotland—A Glasgow newspaper explains a method of keeping petrol or gasoline to avoid waste by evaporation which was being projected in Glasgow by a London concern The fluid is stored in a tank and the storage tank is always full of liquid, no air being admitted at any time The tank may be filled with all gasoline or part gasoline and part water, water being pumped into the tank to force off the gasoline when it is desired The water is drained off when it is desired to replenish the gasoline in the tank Means are provided for preventing water from passing off with the gasoline, and it is claimed that there is no loss from evaporation, no gas is forced out in refilling the tank and the gasoline will not deteriorate no matter how long it is kept in the tank

City Gas for Engine Testing—By way of reducing overhead expense, one of the largest of the Detroit automobile manufacturers has adopted the novel expedient of testing his engines on city gas Preliminary to being placed in the chassis all engines are "run in" under their own power for periods upward of an hour and the expense for gasoline is no small item Under the new *regime*, however, it is estimated that sufficient city gas to run one engine as long as it would run on two gallons of gasoline at 17 cents a gallon, which is the wholesale price, costs in the neighborhood of 8 cents Inasmuch as the manufacturer in question will build at least 150,000 engines during the year, it may be appreciated that the saving for fuel will be considerable The same method has been adopted abroad in some of the large Coventry factories with gratifying results

Accelerators and Instinctive Bracing—It is a psychological fact that the imminence of collision causes the driver of a motor car instinctively to brace himself against the impending shock, which brings to light that if he has his feet where they logically should rest, one on the clutch pedal and the other on the brake pedal, the greater the bracing the better will be the result, for the clutch then will be disengaged and the brake applied automatically The danger arises, however, when, as so often is the case, the right foot rests not on the brake pedal but on the accelerator Instinctive bracing, which may come before the mind acts quickly enough to cause the foot to be shifted, then results in the car being rushed pell mell into the danger The moral is obvious, and should be plain to the person of average intelligence without further dissertation.

A Telephone Transmitter Without a Mouthpiece

By H. R. Van Deventer

UNTIL the presentation of Prof Whitehead's paper on the oscillations of a telephone diaphragm at the annual meeting of the A I E E at Boston last year, but little was understood regarding this important detail and therefore practically all the commercial types of instruments have employed the same type of diaphragm as found in the very first instruments designed. The attention of most inventors has been directed toward refining and perfecting the structural details, and especially the resistance cell Although this is a very important part, it is no more so than the diaphragm. Tyndall has found that the points of greatest vibration in a circular diaphragm clamped at its periphery are at a point midway between the center and the edge Whitehead found that the diaphragm had two distinct motions, one superimposed on the other, one consisting of circular nodes and the other of oblique or diameter nodes.

A new transmitter is illustrated herewith which is the result of over five years of careful investigation of the properties of vibrating diaphragms. Instead of employing a loose diaphragm made of some dead metal such as aluminium which is commonly employed for the purpose, phosphor bronze is employed, which is rolled to produce an initial tension The diaphragm is then formed without drawing the temper, into a pan shaped disk the projecting edge of which is securely clamped, leaving the central portion free to vibrate like a drum head.

A resistance cell of the ordinary type is connected to the center of the diaphragm by means of a spider shaped member having a plurality of feet which are soldered to the inner surface of the diaphragm. These feet, being equidistant from the center, pick up the sound vibrations at the maximum point, and it will be noted that this method of connection is entirely different from the ordinary method wherein the cell is connected to the diaphragm at the center The cell with the diaphragm is placed in a back casing, the various parts being illustrated in the accompanying photograph. A connection is made between the front electrode of the cell and an insulated terminal carried on the casing in such a manner that the circuit is confined to the electrodes and granular carbon, so that no part of the casing or diaphragm is in circuit Certain other details of construction, all very simple and easy of manufacture, result in an instrument which is absolutely watertight, as it may be immersed in water for hours or even days without any damage whatsoever The casing being of brass and the diaphragm of phosphor bronze, there is no corrosion such as commonly occurs in transmitters where aluminium diaphragms are employed

As the sensibility of the instrument is considerably increased by the improved diaphragm construction, it is possible to dispense with the usual mouthpiece as commonly employed Telephone companies figure, especially in the case of desk sets, that the annual maintenance cost for mouthpiece replacement is as high as 50 cents per telephone. The new instrument eliminates this charge, as the mouthpiece consists of a flat perforated metal guard which is practically indestructible

Being water proof, this transmitter offers a perfect solution for the troubles met with in mine and railroad telephones, police boxes, testing sets, and instruments used in other exposed locations. It can be used in the operating rooms of hospitals, as it can be flooded or immersed in a sterilizing solution without injury The cell, being in an air and water tight chamber, cannot deteriorate, and being directly surrounded by the metal casing, interior air spaces being reduced to a minimum, the heat due to the passage of current through the carbon is rapidly dissipated

The sanitary features of this new instrument should be evident, the mouth piece can be thoroughly cleansed, and as it is flat it will be often wiped off, which is not the case with the usual funnel shaped mouthpiece. From tests made in several of the university laboratories and by the writer, the instrument, in its commercial form, was found to average from three to seven miles better in terms of standard cable than transmitters of ordinary construction.

The accompanying photograph represents the transmitter without guard or back shell, submerged in a fish globe filled with water The looking glass, behind the globe reflects the rear casing and attached wires. This exhibit was shown at the meeting of the National Independent Telephone Association at Chicago, Ill The transmitter was connected with a testing set, adjusted for use on a long distance telephone line and operated by two sets of fifteen dry cells, each set in series, and both sets connected in multiple. The room at the hotel was fitted with the usual telephone subscriber set, and the submerged transmitter, through the testing set, was connected with the city telephone line. The Chicago operator was requested to connect with a certain office in New York and the following tests were made

Talking in an ordinary tone, six inches away from the fish globe, against the submerged transmitter, a conversation was carried on for over five minutes and New York reported that the transmission was perfectly distinct, and that the voice was heard in natural tones.

Telephoning from Chicago to New York with a submerged transmitter.

Following the conversation a repeating watch was held against the side of the globe and the striking of the hours and quarters was distinctly heard in New York The transmitter was submerged from 8 P M. Monday, February 17th, until the close of the convention, Thursday, February 20th 6 P M, or 75 hours. Then it was taken back to New York and again submerged in a globe of water, giving perfect transmission.

The Anesthetizing Machine of Prof. Dubois

By Jacques Boyer

IN a recent communication to the Academy of Sciences of Paris, Prof. Raphael Dubois opposes the method of producing anesthesia by way of the alimentary canal, which has lately been proposed by various writers, and shows that his anesthetizing machine, herewith illustrated, offers the most certain and most uniform means of administering chloroform.

The anesthetizing machine invented by Prof Raphael Dubois of Lyons, France.

The apparatus comprises a pump, an automatic device for introducing a measured quantity of the anesthetic, and a chamber in which the dose is evaporated. The pump has a piston of peculiar construction which is moved by turning a handle At the end of each stroke of the piston a definite volume of air enters the pump barrel, carrying with it the vapor of the measured quantity of anesthetic that has been automatically poured into the evaporating chamber by the descent of a plunger into the vessel containing the liquid anesthetic. In the return stroke of the piston the mixture of air and vapor is expelled from the pump and replaced by an equal quantity of a precisely similar mixture. In this way a continuous flow of his standardised mixture can be maintained.

The mask with valves, which is commonly used when the anesthetic mixture is drawn from a gasometer, and which may cause accident through derangement of the valves, has been replaced by a valveless mask, which allows the patient to breathe, without annoyance, in a current of air containing a known and constant proportion of anesthetic. In this method no danger attends an excessive rapidity of administration of the mixture, and the only inconvenience caused by supplying it too slowly is the possibility that the patient may be roused from the anesthesia by the inspiration of fresh air

At the beginning of the operation the plunger is raised to the top of its course, the liquid anesthetic (chloroform or ether) is poured into its container and the handle is turned until the lower face of the plunger touches the liquid. The operator then applies the inhaling mask to the face of the patient and turns the handle until the dose of anesthetic has been expelled into the evaporating chamber

After anesthesia has been produced a buccal or nasal tube, or the tracheal cannula which the photograph shows lying on the glass table of the apparatus, may be substituted for the mask, if an operation is to be performed on the face

The advantages of the method of Prof. Dubois are manifold. In the first place, the surgeon knows exactly how much anesthetic is being administered, which is not the case when the liquid is introduced by manual methods, even when it is applied in drops with a registering pipette. In the second place, anesthesia is produced in a regular and continuous manner This arrangement is particularly important for the prevention of vomiting, which is a symptom of return to consciousness. Finally, the excitement attending the initial stage of anesthesia is entirely eliminated, or, at least, greatly shortened and diminished, even with alcoholic patients. The applications of the machine which have already been made have proved the correctness of previously published appreciations of the production of anesthesia by mechanically compounded mixtures, and it is possible that the majority of surgeons will decide to employ this thoroughly scientific apparatus.

A New Theory of Sleep

THAT we sleep, not because we are exhausted, but in order to avoid being exhausted, is the way in which the Geneva physiologist, Claparède, formulates a new theory According to this conception, which has been further elaborated by Trömner, sleep is not the result of fatigue, but an impulsive self-disinfection process, which the body from time to time conducts against itself, so to speak, in order to get rid of waste products before they have a chance to become injurious. This view is expounded in an article by Dr Adolf Koelsch in *Die Woche*

He draws attention to the fact that just as combustion of fuel for the production of heat and energy is always attended by ashes and slag, so the slow combustion which produces heat and energy in the body by means of metabolic changes, is likewise attended by waste.

We read, "Since the senses never come to rest voluntarily or shut themselves off from the outer world, a point would eventually be reached when the organism would perish as a victim of general nerve exhaustion.

"In order to hinder this, Nature arranges betimes, i. e., before exhaustion can seriously injure the organism, to set in motion that opposition current which we term sleep."

Again, "The sight-endowed animal tends to take its sleep at night, since the stimuli which govern the animal's vital activities are then cut off."

For animals endowed with other special senses, but not with sight, the night is not so great a factor. "These can only blockade stimuli to the senses either by creeping into some secluded spot or by the action of Nature in causing an *opportune* production of a substance (a sort of *hormone*) which acts as an obstacle by entering the nerve path and deadening sensibility. There are numerous indications that the latter is what actually takes place."

It is believed that a sufficient degree of satiation is one of the influences which create such an obstruction, but the whole subject is still in need of extended investigation. Koelsch has also obtained [illegible] results.

Seeing Under Water

How Things Look From a Fish's Point of View

By the Berlin Correspondent of the SCIENTIFIC AMERICAN

OCEANOGRAPHY, thanks to the many investigations made from a geographical and physical viewpoint, has, during the *last few* decades, made enormous strides. We are now able, e. g., to gage with a fair approximation to truth, how light is distributed in the depths of the sea or a lake, what gradations of light and color are to be expected at certain depths, and what are the conditions of temperature from the surface down to the bottom. However, nobody seems so far to have examined in a comprehensive manner the question as to what an eye placed below the surface of the water would see and perceive, and what impressions it would receive from this rather unusual standpoint, of its immediate surroundings in the water, but especially of the world outside.

The experiments recently made on vision below water by a German scientist, Dr Otto Baron v. u. z. Aufsess of Munich, are therefore of more than passing interest and likely to appeal to the physicist as well as to the fisherman and angler.[1] In order better to understand their purport it will be as well, by way of introduction, to summarise the physical conditions on which vision is based.

It is well known that a beam of light striking a transparent substance (e. g. water) of different density from air, undergoes at the boundary a variation in its direction, on account of the difference in the velocities of light in different media. Again, the ratio between these velocities in two given media is a constant figure known as their index of refraction, which is expressed by a mathematical relation between the angles of incidence and refraction respectively. Since a beam of light entering air from water under an incidence of 48½ degrees is broken along the water surface, those beams which come from angles greater than 48½ degrees can no longer issue into the air, but are reflected in their entirety from the water surface, the limiting angle being called "angle of total reflection."

What, then, may we expect to see on entering the water of a lake and trying to view the outside world from this unwonted position? Presuming the water surface to be perfectly calm, we immediately witness the following remarkable phenomenon: Whereas all objects immediately surrounding us in the water are seen in their natural size and shape, anything situated outside the water, i. e., the whole of the outside world, appears strangely distorted. It is true that objects situated vertically above our heads, i. e., in the zenith (clouds in the sky, etc.) have preserved their true shape, but as our gaze sweeps down toward the horizon, objects will change their wonted forms until at the horizon itself all vertical distances have become so greatly shortened that nothing can be recognized.

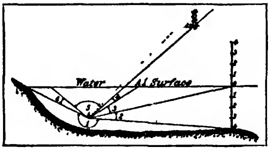


Fig. 1.—Diagrammatic explanation of underwater vision.

What is the reason of this strange phenomenon? In connection with our reference to total reflection we have seen that there are no visual beams connecting the water and the outside world, beyond an angle of inclination of 48½ degrees. In fact the whole hemisphere of 180 degrees, constituting the outside world, is reproduced in the water within a cone of 97 degrees. While a fish thus is able to see all objects of the outside world—even an angler coming toward the water's edge—he sees everything, with the exception of the zenith, deformed and on a shortened scale. Moreover, the cone of 97 degrees just referred to is, at the limiting angle of total reflection, lined by a colored fringe due to the dispersion of colors in water, the red edge being turned downward and the blue and violet upward.

The horizon of water dwellers thus is extremely limited as compared with that of dwellers in the air, while even the form and size of objects in the air appear to them different from what they do to us. However, a person placed in the water will be even more surprised on viewing an object situated partly in air and partly in water.

Let us first consider an ordinary measuring staff, as in Fig. 1, half of which is situated in water and half in the air. An eye placed under the water at *A* sees the submerged portion in its natural shape and size within the angle 2. The portion outside, however, becomes first visible in the cone corresponding to total reflection (angle 5); the upper portion of the staff thus appears in the direction of the limiting angle of total reflection. Being situated immediately above the water horizon, the whole of this portion appears extremely shortened, in fact as a small object far distant from its direct continuation in the water, in an oblique direction above the water surface. Thus the staff is seen as two separate and altogether dissimilar parts.

Within the angle 3 is seen the *reflection* of the lower portion, and in the angle 4 the remaining lower surface of the water up to the limiting angle of total reflection. In the angular space 1 the eye sees the bottom of the lake from the staff to the bank and in 6 the reflection of parts thereof.

Observation with the naked eye under water is unsatisfactory because it is impossible to stay under until the surface is undisturbed and one must limit himself to observing his immediate surroundings in the water. As his eye is only adapted for vision in air all objects, on account of the different refraction of the water, will appear hazy and without any sharp outlines. The hands and body will have a sponge-like, jelly fish like appearance, even the stones on the bottom looking like parts of a pulpy mass. Any more distant objects,

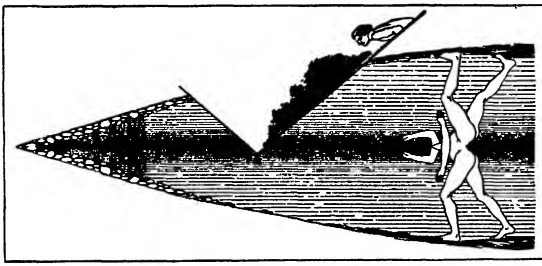


Fig. 2.—How objects are distorted when viewed from a point under water.

The eye *A* placed under the surface *W W* sees a four-armed and four-legged monster entirely disconnected from the head and upper body

Fig. 3.—View from under water of a partly submerged tree.

Fig. 4.—How a man standing in water looks to a fish. The limbs are doubled by reflection while the disconnected head is distorted by refraction.

From Illustrated London News.

Fish-eye view of a heron walking in water.

From Illustrated London News.

Note the reflection of the heron's legs on the under surface of the water.

[1] [illegible]

for instance the body of another human being, will appear quite indistinctly, as though through a dim green glass or a greenish haze. Such are the results of Baron Aufsess actual experiments in the particularly clear water of the Walchensee

But he has made more interesting observations by means of a mirror placed under the surface

It was interesting to ascertain whether the silver-white armor of scales surrounding the abdomen of fishes is an outcome of adaptation to a bright reflex actually existing at the water surface, the fish becoming practically invisible to their foes. The supposition that such a reflection would be visible on the surface whereever on account of total reflection no light is allowed to come out of the water was found to be erroneous, the water surface being even darker than the surroundings and showing the color of the lake (green or bluish green) On the other hand, the circle corresponding to the cone of outside vision is extremely bright, and if the surface be even slightly stirred, each wave will produce a flickering glimmer so that a fish in this region doubtless becomes invisible to his foes, on account of his silver armor

As regards the appearance of outside objects, houses and trees situated close to the water's edge are hardly recognizable as such, so flattened do they appear, while their lower portions are entirely invisible Nor are the stones at the water's edge seen any longer In fact, the roofs of the houses and the tops of trees look as though they rose directly from the water Even high mountains appear from the middle of the lake as though they were slightly more than low eminences or at most flat hills. Most comical, however, is the appearance of a man standing nearby at the water's edge, his legs nearly up to the knees disappear, only the body being visible from this point, but compressed like a ball. What wonderful colors are, however, shed over this man and his surroundings! His face, arms, hands—in fact everything—is shining in the most beautiful colors of the spectrum, each bough of the adjoining trees, every leaf is surrounded by a spectrum of its own, so that one could believe the trees to be dotted with shining rainbow pins. Wherever the bright sky is visible through the boughs, red, yellow, green and blue draperies are seen The distant mountainous banks of the lake appear so flattened as to look like a dark horizontal stroke, but even they have their colored fringe, though only the red and yellow can be distinguished. If, now, the mirror be placed somewhat more obliquely, the true shape of an object is seen to be rendered the more faithfully as it is situated closer to the zenith. Still, it retains the wonderful colored edges above referred to

Fig. 2 represents the impression received by an eye placed in very clear water, of a man walking up to his hips in water Will the monster approaching the observer be recognized as a human being? In accordance with the broken appearance of the measuring staff (Fig 1), the water dweller sees the part of the human body immersed in the water, walking on the bottom of the lake in its natural size and shape. This part of the body, however, is reflected at the same time from the lower surface of the water, thus producing an identical though reversed image with the feet pointing upward as a continuation of his lower body The upper body which emerges from the water, first becomes visible in the angular space corresponding to total reflection inside which the outside world is reproduced It is thus seen from the eye *A* upward in an oblique direction in such a manner that above a colored band on the water surface only the flattened upper parts of the body are visible, surrounded by a luminous colored edge all the remainder having disappeared In fact, the man will produce on the water dweller the impression of a strange being. Fig 4 shows a front view of the same phenomenon. The view toward the stony bank of the lake (Fig 2) is likewise remarkable On account of the similarity of the reflection with the real picture of the lake bottom, the eye seems to look into a tapering narrow slit paved with stones on the top and beneath, above which the water's edge appears in the same manner as above described. The reflecting water surface is only visible where it comprises bubbles or floating objects

Another method of studying underwater vision was described in the SCIENTIFIC AMERICAN of December 28th 1912 It involves the building of a subaqueous chamber from which fishes may be watched and photographed Herewith are two underwater photographs taken by Dr Francis Ward, showing a heron walking in the water The mirror effect of the surface of the water is clearly brought out although the reflection is not perfect because of the ripples stirred up by the bird

The Aeronautical Society's Coming Aviation Meet

A THREE-DAY aviation meet will be held at the grounds of the Aeronautical Society at Oakwood Heights, S. I., N Y beginning on May 30th. Lieut. Riley E. Scott will demonstrate his bomb-dropping apparatus with which he won the Michelin prize in France last summer, and Cecil Peoli, Capt. Baldwin's youthful aviator, will blow up a paper fort by means of wireless electric waves sent from his biplane George Dyott will make flights in his new monoplane, and the new following-surface monoplane of H. G Nichols will receive its initial try-out. Shooting at small free balloons from an aeroplane will be attempted again and Lapham will jump from Harry Brown's Wright biplane in mid-air and again demonstrate Leo Stevens' new "safety pack"—a light silk parachute worn like a knapsack and which opens automatically almost the instant the man leaves the machine, and without his doing anything whatever Every aviator and passenger should wear one of these "air" life preservers in case of a fall.

A Straight Line, Apparently, Not Always the Shortest

LIKE all good puzzles, this one is very easy when you know how

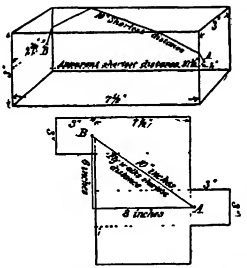
Suppose there sits upon a table a six sided block of glass which is 7½ inches long and 3 inches each wide and high

On the right hand end, at a point one fourth inch from the front and half way between top and bottom, sits a fly

He is required to crawl, over the outside of the block, to a similar point diametrically opposite the one he now occupies, on the other end of the box

He is a very lazy fly, and has a strong desire to crawl as little as possible.

What is the least possible distance he can cover



Showing that sometimes a straight line is apparently not the shortest distance between two points.

in getting from point *A* to point *B*? (See sketch.)

This looks easy It seems obvious that the fly has only to crawl straight out to the front, straight along the front of the block and straight back along the left hand end, to make a perfectly straight line between the two points. A moment's thought will show that he crawls one fourth of an inch on the first end, seven and one half inches on the front, and two and three quarters inches on the other end—total, ten and one half inches.

But a really clever fly would crawl from point *A* to point *B* without covering so long a distance!

There are plenty of paths the fly can choose He can crawl diagonally from point *A* to any other point he chooses and take another diagonal from his first turn, he can crawl along the edge and over the corners, but how can he select a course which will be less than ten and one half inches?

Having puzzled your friends with this, take a piece of paper and lay out a diagram (see second sketch), which is the block "unraveled," or taken apart, and on a "scale" of one quarter of an inch to the actual inch. By cutting this figure out of paper and folding it along the lines, it can be made into a representation of the glass block

If, now, you will draw a line from point *A* to point *B*, and measure that line, you will find that it totals exactly ten inches the fly had to crawl over Yet when the unraveled box is folded, it is obvious that it would take a very clever fly, and a clever boy, too, to think out the apparently devious line of travel which is, in reality, the shortest distance between the two points.

But, in spite of the apparent contradiction of mathematics in this little puzzle, it is strictly according to the letter of the law, for the line from *A* to *B* is to be regarded as the hypotenuse of a triangle, of which the sides are lines drawn from *A* and *B* and meeting at right angles. Measure these sides in your scale and you will find that one is eight inches and the other six inches.

Now, the hypotenuse of a right angle triangle is the square root of the sum of the squares of the sides. The square of six is thirty-six, the square of eight is sixty-four, their sum is one hundred, and the square root of one hundred is ten—which is the distance from *A* to *B* in your unraveled block.

Transporting a Locomotive on a Cableway

AMONG the problems confronting the engineers who are constructing in the West the enormous storage dams for irrigation, transportation of heavy machinery is one of the most difficult. The location of the sites for these dams is usually in a region remote from railroads and often quite inaccessible until highways have been carved out of the steep-walled canyons.

Arrived at the site of the big work, the moving of heavy machinery and materials from one side of the canyon to the other is a problem calling for considerable ingenuity and nerve on the part of the engineer In late years wonderful progress has been made by the manufacturers of cableways and their efficiency has increased greatly To-day the cableway when properly installed becomes the great transporter and solves in a large measure the difficulties which are encountered when working in deep canyons through which flow turbulent streams.

The series of cableways erected at Elephant Butte, New Mexico, have been employed to weighty advantage in transporting many thousands of tons of material and machinery Recently it was found necessary to transfer a 20-ton dinkey engine across the canyon. The method employed is shown in our frontispiece illustration Fearing the weight of the engine might too severely test the strength of a single cable, the engine was swung across on two cables and was safely landed at its destination on the other side The length of the cableways from one tower to the other is 1,450 feet and the height of span above river bed is about 280 feet.

The Elephant Butte dam which is to be one of the greatest works of the Reclamation Service, blocks the entrance to a comparatively narrow walled canyon in the Rio Grande River, about 120 miles north of El Paso, Texas. The structure will be of rubble concrete gravity type built straight and not curved like the Roosevelt dam in Arizona. It will have a maximum height of 275 feet, will be 1,200 feet long on top and contain 500,000 cubic yards. The reservoir created by the dam will have a superficial area of 40,080 acres and a capacity of 2,627,000 acre-feet. The reservoir will have a capacity of 39,025,600,000 cubic feet more than that of the Assouan in Egypt. It will serve a double purpose in that it absolutely protects the lower valley from destructive floods and insures an abundant water supply to 180,000 acres of land in New Mexico, Texas and old Mexico. It will restore to cultivation and intensive agriculture thousands of acres which have been abandoned by reason of water shortage. It will provide homes on the land for 3,000 families and increase the taxable wealth by many millions of dollars.

The Current Supplement

THE old fashioned gold miner has been succeeded by a steel monster which digs out in one minute more earth than the huskiest man could have uncovered in a day The largest mechanical gold dredge in the world is illustrated and described in this week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT.—Extracts from the report of the American Consul General at Berlin, on the conditions of aeronautics in Germany to-day, brings much valuable information to those interested in the newest branch of engineering.—An oscillating propeller for ships, which is claimed to possess certain advantages over the screw propeller, is described by its inventor, H. C Vogt of Copenhagen, Denmark.—In wireless telephony it has been found necessary to substitute for the Hertzian oscillator a generator adapted to furnish currents of such high frequency as 200,000 cycles per second. Such a generator is described by Mr E. F W Alexanderson.—Dr H. Warth illustrates by means of examples—one thousand analyzed rocks—a new system of classification for igneous rocks, based upon their chemical composition.—An article by Mr. F. A Perret on the lava fountains of Kilauea is illustrated with some very fine photographs of lava streams obtained by means of a telephotographic lens.—J. S. Stone's article on the propagation of high frequency electric waves along wires is concluded in this issue.—Mr P Q. Keegan writes on the chemical nature of Floral Blue.

The Iceberg Patrol.—It is announced from Washington that the revenue cutters "Seneca" and "Miami" have been detailed to patrol the transatlantic steamship lanes to protect shipping against icebergs, supplementing the work of the British whaler "Scotia," a notice of which we have already published. Daily wireless reports will be made to the Navy Department.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The History of the Arch

To the Editor of the SCIENTIFIC AMERICAN

In your issue of April 19th there appears, in the article on "Babylonian Excavations by the Germans," the following statements "Though we have long been taught that the arch was of Roman origin, the arch of this sewer was perfect and symmetrical and from an age not far from 4500 B C " If later and fuller research corroborates this date, this will undoubtedly be the oldest arched structure on record, though it is hardly true to give to the Romans any credit for the invention of the arch. Many very early brick arches have been found, notably at Nippur in Babylonia (in 4000 B. C) and in Egypt at Rekakna (3500 B. C), Dendera (in 3000 B C), and beside the Ramesseum at Thebes (13th century B C) The earliest known masonry arch has been found in a tomb at Bet Khallaf in Egypt and belongs, according to Prof Breasted, to the 30th century B C Arches were, as a matter of fact, used all through the ancient world long before the Romans and were, as a matter of fact, invented by no one race. The wonder is that this form of construction was not known to the Greeks, though Fowler and Wheeler ("Greek Archeology," p 181) mention examples as early as the fifth century It is strange enough that pre-Hellenic Greece, whose relations with Egypt and the East have been proven, continued to rely on the clumsy corbeled arch, and more so that classic Greece, whose construction was so perfect in every respect, made no use of the arch, with which they must have been familiar, save in one or two isolated examples. Perhaps some one of your readers can explain the reason for this. CYRUS HAMMOND

Balliol College, Oxford, England

Kapok as Stuffing for Life-saving Appliances

To the Editor of the SCIENTIFIC AMERICAN

My attention was drawn to an article in your issue of January 18th last about "His Mattress a *Liferaft*."

Inclosed I send you a booklet edited by the Department of Agriculture at Buitenzorg, Java, Dutch East Indies, wherein you will see that the best material for such purposes is the genuine kapok fiber (*Ceiba pentandra L.* or *Eriodendron anfractuosum D C*) growing in Dutch East India and also in the Philippines.

The German navy and many passenger lines are using Java kapok only Lifebelts, lifebuoys, mattress rafts, deck chair cushions, waistcoats for sailors working outside shipboard, may be stuffed with it. It is not necessary that the cover be waterproof, the fiber alone will have buoyancy enough J BLEY

Selokaton, Java.

A Plea for the Enlisted Marine

To the Editor of the SCIENTIFIC AMERICAN

Your very able and timely article on "Reorganization of the Navy Personnel" is almost exclusively taking care of the officer, and while you are at it, why not break a lance for the "enlisted marine," who in numerical proportions surely is an item to be figured with.

At present the prospects of this latter class are indeed limited, and with a growing navy these prospects do not grow in proportion. Some means should be found to provide civil positions in the Government service for honorably discharged soldiers and sailors, similar to the practice in vogue in the German army and navy The navy especially will always suffer for want of mariners because the pay is small and the possibilities of pleasant married life remote, while with some such arrangement as guaranteeing the honorably discharged men civil service preferment in police, court, land office, etc., inducements could be created which so far nowhere are offered.

Chicago, Ill. E GAIDSIK.

The "Flame" Detector

To the Editor of the SCIENTIFIC AMERICAN

In your issue of March 15th appeared a note to the effect that the German, Leithauser, had discovered that a flame, especially if enriched by potassium salts, will act as a detector for wireless waves. It should scarcely be necessary to remind your readers that Leithauser is nearly thirteen years behind in his "discovery "

I observed this phenomenon in September, 1900, and it has been frequently described in scientific papers, especially in a paper presented by myself before the American Institute of Electrical Engineers in August, 1906. The "flame" detector was the first "hot gas" detector and the forerunner of the present audion, which is now known to almost every wireless man, especially in America. The flame and incandescent filament audions are covered by twelve United States patents; the basic one being No. 979,275 of December 20th, 1910, filed February 2nd, 1906. LEE DE FOREST.

Palo Alto, Cal.

"Moon-Farming"

By Charles Fitzhugh Talman

SCIENTIFIC men devote a deplorable amount of time to felling Antaeus, in the shape of one or another of a host of irrepressible superstitions. Whether the giant happens to be the equinoctial storm, or unlucky thirteen, or the climatically omnipotent Gulf Stream, or the super moon, the Hercules has not yet arisen who shall crush him conclusively in midair Superstitions are to be dispatched in no such expeditious way, but die by inches and prolong their agonies over ages. The super moon is waning, but its decrescent light will still glimmer in the dark places when our posterity has used up all the coal, and is doing undreamed-of things with radium

It is elementary that, let any belief once get firmly rooted in the public mind, there is always plenty of evidence serving to confirm and perpetuate it. The well known process of "counting the hits but not the misses" insures longevity to the grossest delusions. It is, therefore, not surprising that a certain group of superstitious opinions and customs connected with the moon, which pertain especially to rural affairs, and to which Prof L. H Bailey has applied the felicitous collective name of "moon farming," having once been well-nigh universal, should still flourish in the back blocks of civilization. It is, however, one thing to account for their present vitality, and another to explain how they came to gain such a hold upon the minds of men. Bailey has enumerated the more familiar of these as follows [1]

"The pork from pigs killed in the old of the moon will shrink when cooked, but it will retain its size if killed in the new of the moon Animals born when the moon is new or increasing will be much more likely to thrive than those unfortunately born at the opposite period. Fleeces will not be so heavy if sheared when the moon is on the wane Meat decays with unnatural quickness if exposed to moonlight. In the new of the moon is the time to set hens, to plant corn and other things that grow above the ground. Planted in the old of the moon, seeds of such plants will probably rot. On the other hand, crops that grow under the ground as potatoes and beets, should be planted in the old of the moon, and plants that tend to run too much to vine and straw also should be planted at this period Beans planted when the moon is on the wane will not cling to their poles. Grain purchased in the full of the moon will be of full weight Rail fences sink in the ground and rot if built in the old of the moon If shingles are laid in the new of the moon the nails will pull out. Timber lasts longer when cut in the waning moon. My fireplace wood is 'sappy because it was cut in the waxing of the moon The moon foreshadows changes in the weather It chills and injures plants on clear nights. In the full, it causes wounds to heal It governs mental qualities, and all persons who are unsound of mind are to this day *lunatics* "

Some of these beliefs are easier to refute than others. Certain of them still have their advocates among the illuminati—as witness the fact that the alleged effect of moonlight in promoting the decomposition of fish and other animal substances has been actively debated back and forth in the English scientific journals during the past twelvemonth, and again that its alleged influence upon the flow of sap in trees, and hence upon the quality of timber, continues to this day to be a bone of contention among intelligent foresters and lumbermen Certainly the consensus of scientific opinion is against both of these beliefs. Moonlight is nothing but the reflected light of the sun, with which it compares in intensity in the ratio of about 1 to 600,000, and it seems obvious that any effect of moonlight upon the physiological phenomena of animals and plants must be nullified, for practical purposes, by the preponderating influence of daylight. As to the heat received from the moon, it is absolutely insignificant, and can be detected only with the most delicate thermometric apparatus known to science.

Our present purpose, however, is not to investigate the truth or falsity of these and kindred ideas, but to show that their mode of origin bears no necessary relation to their intrinsic merits, and that the mere fact of their wide currency is by no means to be regarded as evidence that there is "something in them "

In industries of modern origin the moon does not figure. The locomotive engineer does not believe that the phases of the moon affect the running of his iron steed, nor does the telegraph operator consult the lunar tables in the almanacs before renewing his batteries. "Moon-farming" is not quite so old as agriculture, but it is exactly as old as astrology, and in the once universal belief in the mysterious influences of the heavenly bodies upon human affairs we must seek its beginning.

Primitive humanity was naively egotistical. Man was the center around which revolved the whole of creation; and if the sun, moon and stars were not a part of the machinery by which a superior power regulated human lives, why (asked our ancestors) were they set in the heavens? The argument implied in this question was unanswerable, and it only remained to find out just what rôle was played by each of the celestial bodies in the human drama Now it is evident that the moon must have impressed the imagination of primitive man more strongly than any of the other heavenly orbs, not even excepting the sun As compared with the latter, she undergoes rapid and striking changes in form, her times of rising and setting vary conspicuously from night to night and for a few days, every month, she disappears from the heavens. It was, therefore, inevitable to regard the moon as the most active of the agencies controlling mundane affairs, and especially was it natural to link up the erratic behavior of the moon with the equally variable phenomena of the weather

In a more sophisticated but no less unscientific age the primitive moon superstitions were variously embellished and elaborated by the metaphysical processes of reasoning that then prevailed. A good example is found in Virgil's "Georgics." Here are enumerated the merits and demerits of the several days of the lunation, and it is explained that the fifth day after the new moon is unlucky because on this day were born Orcus, the god of the infernal regions, the Eumenides, or Furies, and the Titans, who revolted unsuccessfully against Olympus. Several other lunar superstitions are similarly connected with the stories of classical mythology

An analogous process by which many moon myths originated is explained by Prof Houdaille[2] who made a special study of the superstitions of this class prevailing among the French peasants. The new moon symbolizes youth, vigor and luxuriant growth Hence the belief that plants abound in sap during the increase of the moon and that seeds planted at this time will produce abundant vegetation On the other hand the old moon is a symbol of maturity, plants grown for their fruit or seed should accordingly be sown at this time. The young moon is tender, the old moon tough. Hence when the moon is young eggshells are easily broken through, and this is the favorable time to hatch chickens! The association of ideas involved in these doctrines recalls the old notion of "signatures' in medical botany, according to which a plant with heart shaped leaves was good for diseases of the heart, and so on

Just a word more as to the persistence of beliefs connecting the moon with the weather These are the most prevalent of the moon superstitions, and to a certain extent they are fostered by science itself Meteorologists are, to this day at loggerheads as to what, if any, atmospheric fluctuations (aside from the undoubted but insignificant atmospheric tides, due to the combined pull of sun and moon) are attributable to the moon The subject is a safe one for the trained man of science to discuss, but when the dilettante—and *a fortiori* the harebrained ignoramus—interjects his opinions into the discussion, the results are sure to be fantastic. The very fact that the most patient investigations have failed to establish conclusively the existence of any lunar period in the weather shows that, if the moon does affect the weather, its influence must be infinitesimally small, and, therefore, of no practical importance The latter circumstance, however is overlooked by the public and controversies in reputable scientific circles have undoubtedly created the popular impression that the whole subject of the moon's influence on the weather is far from settled.

Lastly, sham science which the public mistakes for the genuine article, is a most nefarious agency in perpetuating moon superstitions. A familiar example is the table for predicting the weather from the time of day at which the moon changes known as Herschel's Weather Table," so widely published in newspapers and almanacs. As a matter of fact the great English astronomer was in no way responsible for this absurd production, which has borne his name for a hundred years.

[1] *The Independent*, v. 67, 1909, p. 907 ff.

[2] *Le soleil et l'agriculteur*, p. 531.

Gold-tin Cans

THE corrosion of tin cans used as food containers is sufficient to induce investigation As a result of such study Gudeman has made a substitute for tinned iron that is nothing less than gold-iron Tin or iron does not quite fill the pores, but gold alloyed with iron does this perfectly and makes an ideal food container—except for the cost, which is fifteen times that of ordinary tin plate Gudeman applied a liquid amalgam of gold and mercury to the iron plate and then distilled off the mercury The resulting plate looks like gold, resists acids like gold and is absolutely uniform and continuous in surface It was also found that the pores of iron could be filled with enamel or even with glass if a pressure of 50,000 pounds to the square inch were applied, and the resulting product was just as resistant as enamel or glass.

Pipe lines from canal to Natches power house.

Natches power house—central station for a farming district.

Agriculture, Electricity and Irrigation

Intensive Farming Made Possible With the Electrically Driven Pump

By Putnam A. Bates, E.E.

BETTERMENT of the farmers' conditions and improved efficiency in all farming operations are the needs of the hour. Bankers and business men's associations, federal departments, agricultural colleges and important engineering organizations are giving careful study to this basic foundation of the country's welfare, and yet there is perhaps no one improvement that may be counted on so radically to benefit the farmer as the introduction of electricity on the farm.

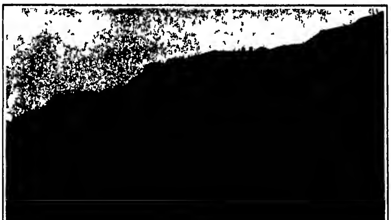
The electric farm, however, is not a new idea, for farms well worthy of this appellation have been in successful operation approximately for ten or twelve years. But there has been very little dissemination of existing knowledge of the use of electricity in agriculture, with the result that farms electrically equipped are under suspicion and regarded as impractical hobbies.

Here I shall endeavor to show that such derogation should cease at once, for we may look for a general use of electricity on the better class of farms in this country before many years have elapsed, and electricity is now being utilized for lighting and power purposes on a much larger number of American farms than many of us realize.

Let us consider for a moment the farms of the Southwest. In some sections of that fertile country, well protected by the mountain ranges, are to be found many electric farms, with buildings lighted by electricity and many of the laborious operations accomplished by the use of electric power. There were our first electric farms, the period of establishment corresponding with the development of the water powers of the nearby mountains.

On the majority of southwestern farms, irrigation is practised, and naturally electricity was first made use of for pumping purposes. Next, under the influence of progressive operators at local central stations, it was generally introduced for light.

Captured waters—forebay of the power canal.



Turbulent waters of the Natches River above the intake canal.

I saw electric lights and electric flat irons in use in farm homes of the Pacific Coast eleven years ago. The people were content to enjoy the advantages which electricity from water power made possible to them, but did not seem to regard their advanced conditions as unusual. Their farms were, in fact, electric farms and their industries, dependent upon the produce of the land, were, as they are now, practically all operated by electricity. I refer to the canneries, fruit packing houses, etc.

The conditions surrounding the farming districts in southern California, for example, at that time, were such that it would have been unusual to adopt any other form of energy, a combination of circumstances being largely responsible for this fortunate situation. The high tension transmission service systems were then new and the companies desired business, and we did not have the gas engines we possess to-day. The efficient and reliable gasoline and fuel oil motors were not developed until several years later. There was pumping to be done, for irrigation was rapidly coming into favor, and, naturally, the electric companies secured the business.

It is difficult to determine whether the power plants, supplying service at rates within the reach of all, made the irrigated farms, or if the electrical load, which these farms warranted, insured the success of the power developments. Both interests seem to have worked together, and in some instances practically the entire supply of the central station current was at once utilized for lighting, heating and power uses on the farms. This was the case ten years ago in the instances I speak of, and according to recent reports, the situation has not materially changed.

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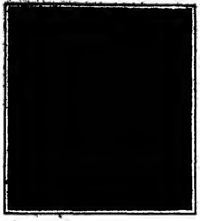
Pump house for irrigating an 800-acre farm.

Garden truck forced to early maturity by [illegible].

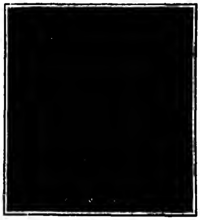


Model of Stephenson's engine, 1816.

Franklin Institute Treasures

Discovery of Keeley's Motor, the First Yale Lock, Franklin's Static Machine and Other Interesting Models in the Underground Storage Rooms of the Old Building

By H. D Jones



The first Yale lock.

A RECENT overhauling of the contents of the cellars of the old Franklin Institute Building in Philadelphia has brought to light a number of interesting models that had been allowed to rust in out of the way corners of the underground storage rooms. Some of these proved so valuable, when examined by members of the Board of Management, that it was determined to select the more interesting for a permanent museum in the new building that the Institute will occupy in the future. The models thus selected have been cleaned and classified and many are now to be seen in the cases at the Institute

Among the models is the original Yale lock, made by Linus Yale in 1855. It is a clumsy looking contrivance with a key big enough to match those of the old-time safe, but its principles were as sound as the perfected Yale lock of the present day A writer with a turn for mathematical calculations spent a long time trying to estimate the number of arrangements of manipulations made possible by the lock, but found it would take more than a lifetime to enumerate them. The lock is a very ponderous affair, but it must be remembered that in those days the old idea that weight made strength still prevailed.

The story of the Keeley motor hoax will live long. Its interest will be enhanced by the preservation in the Franklin Institute of the model of the remarkable motor that Keeley built to deceive intending investors and enrich its inventor until the fraud was exposed after Keeley's death. For twenty-five years Keeley astounded eminent scientists of Europe and America with the machine that he claimed had solved the secret of perpetual motion. The inventor of this machine would start his device going, apparently, by playing a tune on a mouth organ He convinced many clever men that he told the truth, and stock in the new concern sold freely To the day of his death Keeley declared that his discovery was a genuine one, and it was only when the house in which the machine was placed was thoroughly overhauled that the colossal fraud was discovered. Keeley had wired the walls of the building. He ran his machine by high pressure hydraulic power When the wires attached to the machine were the subject of investigation, Keeley would file them to show that they were solid and could not be used for any purpose other than that for which they were attached. Pieces of wire thus filed are to be seen at the Franklin Institute. The broken pieces show that the wires were hollow and that the inventor of the wonderful motor carefully stopped his filing short of perforating the center, which would have exposed the fraud.

There are several other perpetual motion machines in the collection, some of them deliberate cheats like the Keeley motor, some the creation of enthusiasts who miscalculated, but had faith enough in their ideas to carry them to the Patent Office for protection. One of the frauds is the Redheffer perpetual motion machine, which claimed to work on the principle that loaded cars on an inclined plane exercised a constant force to push away the planes This force was supposed to rotate a large wheel. The model actually shows that the force used to deceive investigators of this method of overcoming the rules of nature was obtained through a small wheel, worked by clockwork concealed in the hollow of one of the posts. The clock work was set going by winding one of the knobs seen in the photograph of the model A humorist at the Institute has set at the top of the Redheffer machine a small model of a man trying to lift a trunk while standing on it.

More valuable from a scientific viewpoint than the models of the perpetual motion deceivers is the model of the Stephenson engine, showing the wheels supported on pistons working in steam cylinders instead of springs. The engine weighed about eight tons. The wheels were connected by a chain. The engine proved defective in

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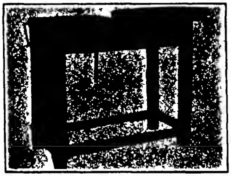
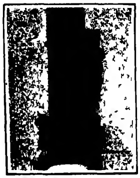
Franklin's static machine.



Franklin's bench for dressing type.



Brush's original arc lamp.

Oliver Evans' "Orector Amphibolis."

[illegible] perpetual motion machine.

Keeley's mysterious motor

Improving a Harbor of Curaçao

One Effect of the Panama Canal's Completion

By Harry Chapin Plummer

In anticipation of the vast benefits which will accrue to the maritime commerce of the world and reflectively to the ports of the Caribbean Sea contiguous to the Isthmus by the opening of the Panama Canal, some of the coast cities of Central and South America and the southern West India Islands are energetically preparing to share in the prosperity that must attend the diversion of transoceanic traffic to the great waterway. One of the communities near the Atlantic entrance to the canal which is striving to gain headway over its rivals is Willemstad, the capital of the Dutch West India Island of Curaçao. In this article the scope of the remarkable improvements which are now being made in that splendid harbor are briefly and clearly outlined.—Editor.

HALF a million dollars are now being expended jointly by the colonial government of Curaçao and corporate interests of the island in the improvement of the harbor facilities of the famous seaport which is distant 675 miles from Colon and forty miles from the coast of Venezuela.

Many of the neighboring tropical cities of island and continent have had to undertake not only the remedying of their port accommodations but fairly to create a system of sanitation. Willemstad, however, has long enjoyed the name of "Spotless Town" because of the scrupulous cleanliness that distinguishes its streets and buildings and the thorough excellence of its water and drainage provisions.

The city of Willemstad is situated on the southerly shore of the Island of Curaçao at the easterly side of a strait known as Ste. Anne Bay, which leads from the ocean into a great natural basin called the Schottegat, and the present scheme of improvement contemplates principally the widening and deepening of the channel approach from the sea and the construction of new docks. The strait, which now averages in its navigable width 120 feet and in the depth from 60 to 80 feet, will be widened to 250 feet, with a minimum depth of 33 feet and of 40 feet in the channel proper.

Work upon the improvement was started by the colonial administration in October last under the authority of a law passed by the Dutch Parliament and ratified by the Queen, and operations are now being actively furthered under the supervision of M. Zelle, director of public works of the Netherlands.

The removal of an obstruction to navigation in the Schottegat in the form of a rocky ledge twenty-three feet under water will complete the improvements that are to be undertaken by the government and for which fifty thousand dollars have been appropriated. As the sides and bottom of the strait and the ledge in the basin of the Schottegat to be excavated are all of hardened coral, submarine blasting will have constantly to be resorted to in the accomplishment of the work.

Conditional upon the actual commencement by the State of operations looking to the betterment of the harbor of Willemstad, the expenditure of private capital to the extent of $150,000 has been contracted for to further the development of the resources of the port, and included in this latter programme is the building of a wharf with about 1,200 feet of docking facilities to extend from the city frontage upon the Schottegat. Among the corporate interests of the colony which have contributed to this outlay are the Netherland Chamber of Commerce in Curaçao, the Royal Dutch West India Mail, a crown-subventioned steamship company that operates regular services between Willemstad and Havre and Amsterdam and intermediate ports in the Antilles and Paramaribo, Dutch Guiana, and New York; the Curaçaosche Bank, Curaçaosche Handelsbond (Curaçao Commerce Association and Curaçao Trading Company), and S. E. L. Maduro & Sons, a coal importing firm.

J. Brokhaus, secretary of the Netherland Chamber of Commerce in America, of which Cornelius Vanderbilt and Stuyvesant Fish are directors, states in the annual report of that body that when the improvements at Willemstad are completed the Dutch West India port will offer facilities for the provisioning and coaling of steamships plying in trades to routes via the Panama Canal such as are not to be had at any other point within a thousand miles of Colon. Coal is imported into Curaçao duty free, he states, and it has been demonstrated that two hundred tons per hour can be placed within the bunkers of calling steamers, while the customs levy upon ships' supplies is so light as to render them obtainable at very reasonable prices. He points with pride to the fact that these advantages combine with the cheapness of labor and the safety, cleanliness and healthfulness of the city to make it a most desirable rendezvous for the disembarkation of passengers during coaling or loading operations.

The city of Willemstad has always possessed a peculiar charm for American tourists, because the quaint Dutch architecture that prevails there is strongly reminiscent of the style of the buildings and dwellings of New Amsterdam and the morning years of the settlement of Manhattan Island, New York.

It is known that during the time in which the proposed acquisition by the United States of the Danish island colony of St. Thomas was under consideration by the governments of this country and Denmark, the Dutch West India possession of Curaçao entered also into the deliberations of the Washington authorities. The proximity of the Dutch island to Panama was, of course, the prime factor in the suggestion that it might be desirable to add Curaçao to the other colonial dependencies of the republic.

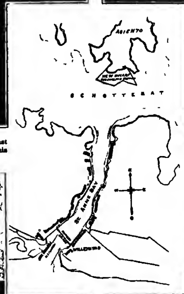
The result of a thorough investigation of the situation and the physical resources of the island, however, convinced the Government that its strategic value was almost wholly commercial, and that while it might be desired as a naval base its maintenance as such would be exceedingly costly, in that it would entail a greater degree of protection than would compensate for its possible usefulness as a lookout point.

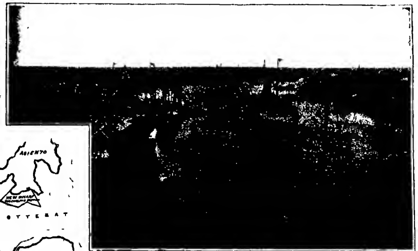
The recommendations that decided against the acquisition of Curaçao are understood to have been, in substance, as follows: Willemstad is an excellent port of refuge and repair for small vessels and torpedo craft, but Ste. Anne Bay is too constricted to permit more than six battleships to move at one time. It is exposed to gun fire from the sea, and, moreover, by reason of its bottle-shaped entrance it could easily be blockaded by an inferior force.

While the sanitary conditions are excellent and coaling and repair facilities are as good as the average, the town is small, and for obvious reasons it is never deemed judicious to give liberty to a large ship's company at a small port, especially at an island port.

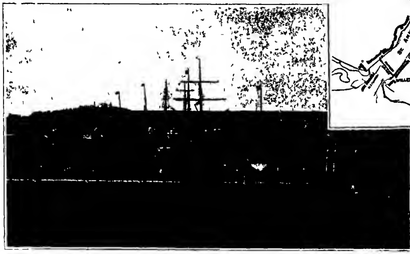
As for the strategic position of Curaçao, it is about the same distance from Colon as Guantanamo, the American naval station on the south coast of Cuba. It is expected that the entrance to the Panama Canal will be fully and amply provided with all docking facilities, coal and repair shops, and that these, too, will be fortified.

The Schottegat, a protected harbor of great size, which affords safe anchorage for a vast shipping. The removal of a coral ledge that forms an obstruction to navigation of this lagoon is one of the improvements now being undertaken by the government of Curaçao.





Entrance of Ste. Anne Bay, looking seaward, the Dutch cruiser "Utrecht" steaming away from Willemstad. Moored alongside the wharves are a few schooners engaged in the local Caribbean trade.



Willemstad's picturesque waterfront along Ste. Anne Bay, showing the characteristic Dutch style of architecture that suggests the early days of New York city.

An ever-busy scene, peopled by motley throngs, is the quay at Willemstad by day and by night, for an excellent electric light system illuminates the waterfront after the sudden tropic sunset.

Willemstad, the capital and port city of the Dutch West India island of Curaçao, is divided into two sections by a strait called Ste. Anne Bay, leading from the sea to a huge lagoon called the Schottegat. A pontoon bridge connects the divided portions of the town. The population is about 32,000, of whom 5,000 are centered at Willemstad, and embraces Dutch, Spanish, English, French, German, and other Europeans and many Caribs, or native Indians. The patois, called "papiamento," which is spoken by the negroes, the majority of the population, is a jargon of the tongues of these several races.

Detecting Raised Checks With Ultra-violet Rays

A DISCOVERY of Dr. Robert W. Wood of the Johns Hopkins University has put forgeries out of business. The most skillful check raisers have worked with chemicals, using a chemical ink eraser to remove portions of the written matter upon a check and then inserting what they wanted to insert in a handwriting that so closely imitated the original that it was almost impossible of detection. As the chemical erasers removed ink from paper in such a manner as to leave no trace of what had been written and made no change in the texture of the paper, it was considered next to impossible to discover any change.

However, Dr. Wood has found that the change may be detected by photographing the suspected check by means of ultra-violet rays. He has a piece of paper on which the words "Twenty-four hundred dollars" appear. The words were originally "Twenty-four dollars." The change was made by an expert who had erased the word "dollars" and the line after the "twenty-four" with a chemical ink eraser and had written the words "hundred dollars" in a manner so perfect that it was impossible to discover any change in the line even with the aid of a high-power magnifying glass. Dr. Wood took the slip of paper and put it under his ultra-violet rays and photographed it, giving it a ten-minute exposure. The result is that a heavy smudge appears before the words "twenty-four," clearly showing that something has been erased and something else written in. The explanation is that in removing part of what has been written a stain was left, invisible to ordinary light, but shown clearly by means of the ultra-violet rays.

Dr. Wood's discovery will be of especial advantage in discovering changes made in documents such as wills, where it is desired that the knowledge that anything is suspected and that an investigation is being made be avoided. It is now possible to discover if a certain sort of chemical has been used by making tests with other chemicals, but the result of these tests is to change the document. Dr. Wood's method makes absolutely no change in the document itself, but the change, if any has been made, shows plainly on the photograph taken by his method.

Tests of the New Navy Flying Boat

PRACTICALLY all the tests specified for the new navy flying boat, which has just been completed by Burgess Company and Curtis of Marblehead, Mass., were completed on the 14th instant by aviator Frank Coffin, accompanied by Lieut. Murray, U. S. N., as observer. The tests were made over a five-mile triangular course in a wind of six to eight miles an hour at the start, but increased to about 10 miles per hour at the finish. Forty-eight gallons of gasoline were carried. The aeroplane rose easily from the water within 1,000 feet, although it had 1,500 feet in which to start under the specifications. The hour's endurance test lasted an hour and eight minutes, after which the machine rode at anchor in the open sea for half an hour in fulfillment of this test. The speed test was the only one uncompleted on the 14th. This new machine is of the flying boat type, in which the aviator sits just in front of the lower plane, which is slightly lower than his shoulders. The motor, a six-cylinder Sturtevant, is mounted well up in the gap between the planes and sufficiently far back for the propeller to clear the upper plane without any of it being cut away. There is, however, a space of about eighteen inches between the two wings which compose the upper plane. A novel feature of this machine is a thin keel projecting down two feet below the bottom of the boat and acting as a centerboard to steady it when running on the surface of the water.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Wave Motors on the Pacific Coast

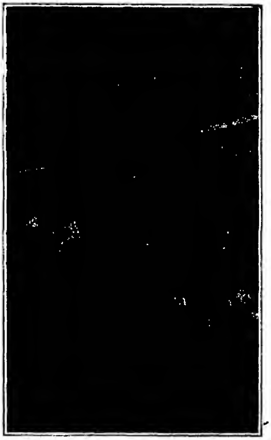
By L. McCully Edholm

THE sight of the ocean uselessly expending its energy on the sands of the shore has started many a man to puzzling over a way to capture this power and put it to use. Just now a number of wave motors are being tried out at various points along the Pacific coast and some of them are of unusual construction.

One of these motors has been installed at Venice, California, and pumps the sea water to a height of forty feet. To generate electricity it is planned to pump this water into a storage tank, allowing it to run through the turbines. A wooden frame is built out from the pier about twenty feet above the water and this supports the motor, which consists of a large wooden wheel ten feet in diameter mounted on a steel shaft. Two heavy timbers extend from the wheel to two feet below the surface of the water, where they connect with a wooden plane placed to receive the full force of the waves. The incoming breakers dash against the plane driving it shoreward, while the receding waves force it violently out again. This motion oscillates the wheel and the power is transmitted to four pumps by means of steel wire cables. The sea water is pumped to a height of forty feet through a three-inch pipe. As the tanks have not yet been placed to receive the water, the spray can be seen in one of the accompanying photographs falling in a shower.

Fully a score of different wave motors are being tried out along the coast. A motor near San Diego works on a somewhat different principle from the one just described, as it is proposed to generate power without the use of a pump. A photograph of this plant is reproduced herewith.

At Huntington Beach a company has recently secured a concession on the municipal wharf on the promise that it will install a wave motor and supply free light to the little town. Hence its development is being watched with much interest.



The 10-foot wheel rocked by the waves operates a set of pumps.

Wave motor near San Diego that does not employ a pump.

Pumping set driven by the wave motor. Note the spray in the background.

How to Sell Inventions

By William Atherton Du Puy

OF course the most directly important point in invention is realizing money upon the children of one's brain thus called into being. There is always a secondary sentimental satisfaction in an invention when it becomes an item large or small, in the progress of the times and contributes its share to the added comfort and well-being of human kind. The inventor is likely to appreciate his service to his fellows and prize this benefit in proportion to its real worth. But if he gets far in invention he must likewise be a practical man and make money out of his labors. This money is, quite naturally, the immediate object of his activities.

Advising the inventor as to the best method of procedure in marketing his patents is rather a difficult task. There are no well known roads to wealth through invention that may be very definitely pointed out. The men who have been successful, however, have a good deal to say on the subject and their advice ought to be of the best. In that they agree as to general principles a good, middle-of-the-road course may be prescribed which, when modified by the exceptions in any given case, ought to get its value out of almost any patent.

The inventor should have thought of the sales end of his creation before he spent much time and energy upon it. An invention intended to add to the convenience of three-legged people might be of great worth to those so constituted but the possible sales would be so few that its development would not be profitable. There are many more two-legged people and it would be better judgment to invent for this larger field. It would be more practical to patent a cotton picker than a daisy picker because there is a bigger industry demanding the former. An improved shoe would have a material advantage over an improved glove for there are more shoes worn than gloves.

The inventor should first ask himself if there is a demand for the thing he proposes to develop. He should attempt to get the viewpoint of the possible purchaser and manufacturer of his invention and judge from that angle whether or not his idea is worth while. He should remember that great numbers of his article must be sold to make its manufacture worth while. He should consider the probable price that the purchaser will be willing to pay for such an article. He should determine whether or not the article can be manufactured with sufficient cheapness that its sales may assure the necessary profits. There may be articles in the market that will compete and this competition must be met. Therefore the inventor should think of the practical problems of the market before he gives much time to a prospective invention.

Upon the completion of his patents, these being of record at the Patent Office, the inventor will receive circulars from half a dozen sources, embodying proposals to market these patents. These circulars will tell of the various methods used by their senders of bringing patents before an industrial world which is waiting on tiptoe for just such inventions. When the patentee answers one of these circulars he will find that a fee in advance is required on one pretext or another. He sends the fee. This is the last he ever hears of the circular senders. I have never talked with an inventor who has ever sold anything through these self-styled benefactors of the ingenious. It would seem that it would be entirely possible to conduct a business of this sort that would be mutually beneficial to the patentee and the manufacturer but as far as I am able to ascertain, no such business exists.

So it is the part of wisdom for the inventor to forego this immediate proffer of possible benefit. He has a better way nearer home. Whoever he is and wherever he live there is, near him, someone who is an authority upon the very sort of thing he has invented. If it is an appliance that has a place in any phase of railroad activity, there are men in the repair shops of the nearest railway division who will be excellent judges of its merits. If it is to be used in the building trades, ask the men who are putting up the business blocks of your home town about it. The local hardware man should be a fair judge of the usefulness of any ordinary tool. It is not likely that you will invent anything with reference to factory machinery unless you live in the atmosphere of a factory town. Then you have your authority to whom to show your models. Whoever you are and wherever you live there are [illegible] to whom you may go for advice. You should remember that the advice of only successful people is worth while. Go to the man at the top. If he is interested something may be accomplished, while the enthusiasm of the unimportant man availeth nothing.

Criticism, condemnation, ridicule of your invention may not justify its abandonment. Many of the greatest inventions have been ridiculed in the beginning. Make the critics show you why your invention is no good. If you are an intelligent man and they cannot show you why, keep up your confidence and your efforts. This criticism will breed new ideas and improvements.

Finally, if your idea is any good, it will come through this fire of criticism. In the meantime it may have attracted backers. The successful men who know most of the sort of industry in which your invention is to be used are the very kind of men who are most likely to finance its manufacture. They understand its usefulness and its possible market. They are successful people and therefore are likely to have money with which an enterprise that promises great profits may be put on its feet. They have financial friends who have confidence in their judgment.

If you have selected important people in your canvass, people who know your line, you will not have gone far before you will have interested someone who may help you. Probably some two or three men may be brought together to start the manufacture of your device. You furnish the patent and they furnish the money. You should be ready to make favorable terms with such people. You may have a patent that is worth a million dollars. You are entirely justified in giving away to the right man one-half of that patent, or a $500,000 value. It is good business on your part to do this if you select the right man as the beneficiary. This course should lead to the manufacture of the article. The right man being interested in the patent may bring it and you into touch with just the right people to make the biggest thing possible out of your invention.

Your invention may be of such a nature that its sale may not be practicable in this way. It may be merely an attachment to a complicated machine and not a complete article in itself. It might be, for instance, an attachment to a typewriter. This attachment by itself might not lend itself to independent manufacture. [illegible] be of use only to [illegible] of typewriters. The [illegible] writer [illegible] should [illegible] its value to a certain extent. The [illegible] experts of [illegible] [illegible]

value. If they are sufficiently interested they may bring the matter to the attention of the factory or they may give you letters to their central manufacturing plant that will get you a hearing.

If your patent is not a thing complete in itself you should get in touch with the manufacturers who make the things of which it is a part. It should not be difficult to get the addresses of great numbers of the manufacturers of any given article. The agents for those articles in your home town can give them to you. If you have received sufficient encouragement and have your patent sufficiently developed to thoroughly demonstrate it, you may find it worth your while to make a trip to the factories that offer possible sales and personally interview the party who is the authority on this particular matter

If your invention is worth while and you present it to the people who are interested in its class and there are no trade reasons why it should not be adopted, you are sure of a sale and should have no great difficulty in making it. There was a time when new inventions were a drug on the market, but that time has passed. The present are the gala days of the inventor Never before has the world known such activity in the development of new things mechanical as at present. It is an age of frenzied activities that tend always to devising new appliances to save the labor of man and new comforts and conveniences to surround him in his ever increasing field of activity. It is the inventor upon whom devolves the responsibility of supplying these, as it has been the inventor who has so largely been responsible for developing activity The inventor has created a very complicated surrounding for modern life and modern life has, in return, offered an unlimited field for the activities of the sort of men who created it.

Notes for Inventors

The Number of Pending Patent Applications.—Apart from the pending applications in the Patent Office under rejection and awaiting amendment or other appropriate action, it is interesting to notice that at the close of business on May 3rd, 1913, the total number of applications in the Patent Office and awaiting official action was 27,332.

Two Great Inventors.—In a magazine article published a few years ago, Thomas A. Edison is reported to have expressed the belief that "inventiveness" can be taught if the pupil has ambition, energy and imagination. Recently, Dr Alexander Graham Bell in a public address on the evolution of the telephone, told how his father encouraged his sons to invent and particularly how he, Dr Bell, before reaching the age of sixteen, had made some important discoveries in sound which, however, he found were not original but had been described by Helmholtz, also how he and his brother had completed a talking machine which would pronounce the word "mama" so plainly that when operated in the hall of the apartment house caused some of the tenants to open their doors to find out whose child was crying Dr Graham Bell told of many interesting experiences leading up to the telephone production and repeated his frequent assertion as to the important part played by his familiarity with the science of sound, telling how the sound and electrical features of the telephone inspired some one, Maxwell, probably, to describe the great invention as the result of a cross-fertilization of the sciences.

Combined Pocketbook and Powder Puff.—The patent, No. 1,049,184, to Anton Widrich of New York city, for a pocketbook and powder puff, will be interesting to the ladies as involving a modification of the popular vanity box. In his patent Mr. Widrich provides a purse-like portion on one side for holding small change or the like and an oppositely located similar portion within which is formed the powder puff, the whole presenting the appearance of a double or two-sided pocketbook, the [illegible] when closed serving as a [illegible] for the powder puff portion [illegible]

A Clock that Needs No Winding.—Two Austrian watchmakers have built a clock which receives its motive power from a current of air blowing upon a turbine-shaped wheel. The clock is so simply built, that the current of air produced by a stove or kitchen range is sufficient to make it go. The air is brought to the clock by a pipe fixed upon the wall. A very strong current is reduced by a certain clever contrivance which regulates the speed of the works. This clock serves at the same time as a ventilator The one built as a sample is installed in a restaurant at Unymarkt and works satisfactorily

A Number of Metal Culvert Patents.—Patents Nos. 1,049,542, 1,049,543 and 1,049,544 have been issued to the Smith Metal Perforating Company of San Mateo, Cal., as assignee of Andrew Smith of the same place. The patent, No 1,049,542, has its sections provided at their meeting ends with integral reinforced terminal portions so formed as to constitute abutments to resist longitudinal stresses, the patent, No 1,049,543, comprises longitudinal segmental sections provided with outstanding flanged edges with the metal doubled back upon itself and extending into its section and having a brace flange lying against the inner wall of its section, while the patent, No. 1,049,544, forms the sections with sheet metal casings having outer corrugated sections and an inner smooth walled metal lining.

How to Straighten Curly Hair—Hair straightening preparations are somewhat popular in section inhabited by the kinky haired We find John Wesley Freeman of Alleene, Ark., has secured a patent, No 1,055,972, for a method of treating kinky human hair which consists in applying to the hair a normally solid oleaginous dressing and then combing the hair with a heated comb to cause the hairs to be straightened and separated and individually coated with the dressing

Preserving Green Vegetables by Cool Water—In patent, No 1,055,353, to Clarence H. Plummer of Black River Falls, Wis., is presented a process of temporarily preserving green vegetables such as peas and beans in which the vegetables are subjected to an upwardly flowing stream of cold water for a sufficient period to reduce their temperature approximately to that of the water

Cigar-bunching Machine—The International Cigar Machinery Company of New York city, as assignee of S. I. Prescott, has patented, No 1,051,005, a cigar machine, which includes in connection with means for shaping a selected number of outspread leaves to produce a Spanish bunch, means which act on the shaped leaves to form a bunch and also means which act on the formed bunch to convert it into a cigar, the invention being characterized by the selection means in connection with the others specified

A Poppet Valve of High-speed Steel.—A patent, No 1,051,845, has been issued to the Rich Tool Company of Chicago, Ill, assignee of George R. Rich of Oak Park, Ill., for a poppet valve, which is constructed of high-speed steel or a steel containing in its composition a percentage of tungsten. It is claimed in the patent that poppet valves of high-speed steel are capable of holding the temper when subjected to very high temperatures and remain in perfect working condition and free from any appreciable carbon deposit after having been subjected to high temperature of gases in an internal combustion engine of an automobile during a run of 4,000 miles.

Two Musical Instruments Combined.—Andreas Radovanovic of Zürich, Switzerland, has secured a patent for a harmonium which has attachments for transmitting the pressure of its keys to those of a piano keyboard so that when the parts are properly coupled up and in close proximity, both instruments may be played simultaneously by actuating the keys of the harmonium.

Life-saving Device for Vessels.—In a patent, No. 1,051,649, issued to Howard [illegible] of Cos Cob, Conn., which has now been assigned to the Government of the United States of America, there is provided life-raft construction which operate to form a part of the deck or decks of the ship in such manner that large portions may be readily detached and launched overboard in case of accident when the ship is sinking or is in danger of sinking.

A Novel Alaskan Sled.—Daniel E. Riley and Carrie Davis Powell of Nome, Alaska, have patented, No. 1,053,876, a sled which has a body and front and rear bob-runners pivotally connected with the body and having an engine mounted on the front end of the body and an aerial propeller at the rear end of the body with its shaft extended diagonally of the body and arranged to be actuated by the engine.

A Series of Chain-pipe Vise Patents.—In patents, No 1,054,661 to 1,054,665 inclusive, are shown a number chain-pipe vises all of which are characterized by the provision of a chain to partially encircle the pipe and a jaw block recessed to engage the pipe together with means for adjusting the jaw to clamp the pipe within the chain. The patents issued to J H Williams & Co. of Brooklyn, N Y, a corporation, on the applications of George Amborn of Chapinville, Conn.

Anti-skidding Device for Automobiles.—To prevent an automobile from skidding, it is the custom to provide the wheels with tire chains The task of applying the chains is a laborious one and takes considerable time. In order to provide a simpler method of preventing tires from skidding, an inventor has devised rollers equipped with several short lengths of chain. These rollers are mounted adjacent to the rear wheels of the automobile and may be brought into engagement with them whenever desired Owing to frictional contact with the wheels the rollers will be revolved rapidly while the vehicle is in motion and the chains will be thrown out centrifugally, bringing them under the tread of the wheels and thus preventing the wheels from skidding Whenever it is desired to remove the anti-skidding device, it is merely necessary to operate a lever which withdraws the rollers from engagement with the wheels and the chains from under the tread. Patent No 1,045,609 has been granted on this device.

Chauffeurs' Signaling Glove.—It is the custom of drivers of automobiles, particularly in cities, to signal with the hand when they are going to make a turn to the right or to the left or when they are about to stop the car, for the benefit of following automobiles. To provide a more effective signal and particularly one which can be used at night, a new signaling glove has been invented (Patent No. 1,046,225) This glove carried a battery strapped to the wrist portion, also an electric bell above the battery and an electric lamp on the back of the hand portion. The circuit of the bell may be closed by touching a thumb contact with a contact on the first finger of the glove, while the circuit of the electric lamp may be closed by touching the thumb contact with another contact on the first finger of the glove In this way the chauffeur may give either an audible or a visible signal.

Multiple Telescope.—An inventor has devised an astronomical instrument consisting of three telescopes so adjusted to one another that their fields of view are coincident. They are mounted on a common stand and the movement of one will cause the movement of the entire series. The object of this triple telescope is to facilitate the instruction of students. The instructor is stationed at the central or pilot telescope and he keeps the object in view, that is in the field of all three, so that the beginners need not be concerned with the training of their telescope, but can devote their entire attention of the study of the object in the field Thus, instruction is made coincident with observation. The instructor, by taking two students at a time, can give his class longer sessions at the telescope. He can also instruct the student at either side in the difficult operation of keeping the object directly in the center of the field of observation.

Legal Notes

The Senate Patent Committee.—The patent committee for the Senate of the 63rd Congress is composed of Ollie M James of Kentucky, Benjamin F Shively of Indiana, Ellison D Smith of South Carolina, Thomas P Gore of Oklahoma, Frank B. Brandegee of Connecticut, William S Kenyon of Iowa, and LeBaron B Colt of Rhode Island. Of these, it will be noticed, only two members are from New England

Presumption from Refusal to Answer.—The Court of Appeals of the District of Columbia, speaking by Mr Justice Robb in the case of Perri v Thoma, held that where, during the taking of testimony, an inventor testified to the finding of a book containing a memorandum which he stated enabled him to fix dates of invention prior to those previously set up, and such memorandum might apply to any one of several inventions for which applications have been filed, and the inventor refused to state at what time each of said inventions was made, his testimony had no probative force. The refusal to answer warranted the presumption that another application than the one in interference might have been filed and to which the memorandum referred. The witness was asked in cross examination at what time he made each of his five applications and was instructed to confine his answer to such applications as had been patented or as were involved in the interference in question.

Some Adjudicated Patents.—In the case of Johns-Pratt Company v E H Freeman Electric Company, 201 Fed Rep, the Sachs patent, No 600,341, for a safety fuse was held valid and infringed The Painter patent, No 792,284, for a method of making bottle stoppers or closures was held valid and infringed in Crown Cork and Seal Company v Brooklyn Bottle Stopper Company The Painter patent, No 887,838, for bottle stoppers was held valid and infringed in Crown Cork and Seal Company v Brooklyn Bottle Stopper Company. The Wheeler patent, No 887,883, for bottle stoppers was held valid and infringed in Crown Cork and Seal Company v Brooklyn Bottle Stopper Company The Lafean patent, No. 945,788, for an improvement in caramel holders was held valid and infringed in American Caramel Company v Glenrock Stamping Company The Lafean patent, No 945,788 was held valid and infringed in American Caramel v Williams. The Roland reissue patent, No 12,933 (original No 907,407), for a subaqueous rock breaker held valid and infringed in Submarine Rock Breaking Company v Submarine Company The Moore patent, No 764,486, for a filtering process was held valid and infringed in Moore Filter Company v Tonopah-Belmont Development Company It will be noticed that in all of the above cases the patents were held valid and infringed

Other adjudicated cases include the Ransome patent, No 694,580, for a reinforced concrete floor in which claims 5 to 10 inclusive were held not infringed in the case of Ransome Concrete Company v German American Button Company The Cardwell patent, No 940,853, for a wallet, which was held void for lack of invention and also held not infringed, is conceded validity in Cardwell v E J Wilkins Company, and the Muller patent, No 1,035,098, for mechanism for producing a walking motion in toy figures, held on a motion for preliminary injunction void for lack of invention in Nurnberger Metall. etc. v. New X Toy Manufacturing Company

Jurisdiction of Federal Court.—In the case The Fair v Kohler Die and Specialty Company, the Supreme Court, speaking by Mr Justice Holmes, has held that where the plaintiff relies upon infringement of his patent and nothing else, the cause whether good or bad is one arising under the patent laws of the United States and the Federal Court has jurisdiction. In this case the defendant pleading to plaintiff's bill for infringement of a patent by selling the patented device below a specific price, denied that there was any infringement of the patent and alleged that the cause was not one arising under the patent law.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

DRESS SHIELD POCKET.—M BARROW care of Barrow Mfg Co., 119 Wooster St. New York N Y This shield is more especially for use on washable garments, such as corset covers and the like, and it permits the convenient inserting of a dress shield and retaining it correctly in place therein and allows of removing the shield from the pocket immediately prior to washing the garment thus preventing injury to the shield while the garment is being washed

ELASTIC FOR CHILDREN'S SOCKS.—ELEANOR M HATFIELD 838 Bedford Ave., Brooklyn N Y This invention provides means for retaining stockings, socks, gloves or similar articles in proper position. An object is to provide an elastic which is adjustable to suit the individual wearer of the garment, and when so adjusted to be capable of being locked or set so that no other adjustment will be necessary

SHIELD FOR CHILDREN'S BLOUSES.—S BARNSTEIN and C. BARNSTEIN 215 Greene St. New York N Y The principal object in view in this case is to provide a shield formed of two sections, by the successive removal of which the throat of the wearer may be exposed to different degrees. By varying the design and color of either section a varied and pleasing effect may be imparted to the blouse at a nominal cost.

Of Interest to Farmers.

COTTON CHOPPER AND CULTIVATOR.—R HAMILTON P O Box 711 Pensacola, Fla In the present patent the invention has reference to combined cotton choppers and cultivators, and has for its principal object the provision of improved means for controlling cutting disks carried by the machine

WEED CUTTING MACHINE.—R. O MARSHALL, 905 E Alder St, Walla Walla Wash This machine is especially adapted for clearing summer fallow ground of weeds, preparatory to seeding, wherein the cutting means moves beneath the surface of the ground and may be adjusted vertically in accordance with the depth at which it is desired to cut the weeds.

Of General Interest.

CONTAINER.—J A ROOS, 101 Beekman St, New York, N Y This invention relates to receptacles for containing and discharging semi-solid, adhesive or pasty substances, such as greases, vaseline, rubber cement, shaving creams, tooth pastes, etc and for hotter in hot climates, and provides a container of any size or shape arranged to be kept normally hermetically sealed when not in use to pre-

CONTAINER.

vent the substance from drying and hardening and when in use to discharge the contents in the form of ribbon or stream It is provided with a discharge opening to alternately open and close the same at each revolution of the valve a plunger for moving the contents of the receptacle toward said opening and a screw rod screwing in the plunger and centrally attached to the valve to rotate with the latter Superior to collapsible tubes and cheaper being easily filled and holds its shape

DOUBLE DRAINAGE AND VENT FITTING.—C N C ROCK 204 W 140th St New York N Y The invention provides a double drainage and vent fitting arranged to provide a plurality of waste connections and a double vent, at the same time permitting convenient turning of the fitting to extend the waste inlets into the desired direction for connection with the waste pipes of the fixtures.

PROCESS OF PHOTOGRAPHY IN COLORS —A J B. TAULEIGNE, Pontigny Yonne and E. MARO, 8 Boulevard de Magenta Paris, France This invention enables photographic positives to be obtained in all shades, by the transformation of an ordinary silver positive into an aniline monochrome The process can be employed for obtaining simple positives in all shades on glass or paper, obtaining superposed bi-colored double prints for projection in relief obtaining trichrome positive for color photography

PROCESS FOR PRODUCING A PRODUCT FOR ATTRACTING INSECTS.—G MAIRE, 108 Rue du Prince Abdel Moneim Alexandria, Egypt This invention has for its purpose a process for producing a product emitting odoriferous effluvia capable of attracting certain insects from a great distance to a trap serving to catch them such as the trap for example which formed the object of patent application serial No. 584,829

MOLD FOR MOLDING CONCRETE.—G. W HERING, P O. New Rochelle, Dean Place, Larchmont, N Y This mold has collapsible cores, whereby a concrete or cement shell may be formed and the core and mold removed without disturbing the shell. The core is connected to the mold, so that the movement of the latter will actuate the former to move the parts thereof out of contact with the shell or core formed.

MEASURING WEIR.—C. W CHEATHAM, Hamilton, Mont. The intention in this instance is to provide a simple, inexpensive, easily set up and operated device by means of which the amount of water to be delivered may be accurately controlled, regardless of fluctuations in the amount of water in the main canal

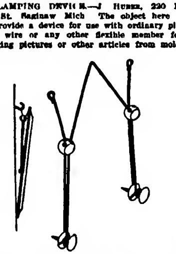
MOORING DEVICE FOR SUBMARINE MINES.—G E. ELIA, Hotel de Crillon, Place de la Concorde, Paris, France This device enables submarine mines to be raised independently of their mooring anchor and the device is intended more particularly for rendering the connection between the mine and its anchor detachable in such a manner that these two members can be recovered individually so as to avoid possibility of accident.

Hardware and Tools.

LIQUID LEVEL.—J L. RUSSELL, Albion Cal. The invention provides a finder for a level wherein is employed an air bubble, the finder providing a traveling surface for the bubble semi-circular in form, provides a graduated scale disposed adjacent the path of the spot of the finder and a movable index for the scale to indicate the position of the spot previously attained or to be attained, and provides means for increasing or diminishing the size or definition of the spot.

VISE.—J T CARTER, care of R. P Reese, Pensacola, Fla The invention relates more particularly to a vise used by harness makers and leather workers the object being to provide a construction whereby clamping members of different types and materials may be interchangeably associated with the jaws of the vise and in this way adapt the vise to the use of the numerous other workers in wood metal and other materials.

CLAMPING DEVICE.—J HUBER, 220 N 4th St. Saginaw Mich The object here is to provide a device for use with ordinary picture wire or any other flexible member for hanging pictures or other articles from mold-



CLAMPING DEVICE.

ings or other supports which permits the effective length of the wire to be adjusted as necessary, which further permits the angularity with which the picture rests against the wall or other support upon which it is to be hung to be varied as desired, which can be manipulated with ease and rapidity and which will not mar or injure the wall or picture

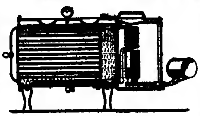
REAMER.—J LORENZ, Robinson Ill This tool is especially adapted for under reaming, wherein the parts may be contracted to permit the passage of the tool through the well cas-

REAMER.

ing, which will automatically expand into working condition when the proper position is reached and wherein a safety device is provided for preventing the accidental displacement of the parts.

Heating and Lighting.

WATER JACKETED STOVE.—M. KELLY, care of G. Taylor, 17 South St., New York, N Y In this invention the object is to construct a combined stove, one part of which is an ordinary gas or oil stove designed to heat a water-jacketed oven to a definite temperature, thermostatic means being provided for



WATER JACKETED STOVE.

removing the heater to an inoperative position relative to the water in the jacket, so as to maintain the oven at a constant temperature

ACETYLENE GAS APPARATUS.—M E. LOMMA, Claypool, Ind. This improvement provides means for agitating the carbid to obtain the full gas production thereof, and provides a generator and apparatus connected therewith to prevent the lodgment or accumulation of sludge therein.

AUTOMATIC CUT-OFF FOR GAS BURNERS.—R. HUGHES, 210 So. 3rd St., Mount Vernon, N Y This invention relates to cut offs for gas burners and has for an object to provide a structure in which the supply of gas will be automatically cut off to a limited extent, so as to reduce the size of the flame when the burner is not in use.

Machines and Mechanical Devices.

GEARING.—ERNST W F HARAMAN 1200 Hays St., San Antonio, Tex. The object of this invention is to couple up at will two independent drive shafts with two independent engines, so as to connect either engine with either shaft, both engines with either shaft, or both engines with both shafts. The invention has special reference to a flying machine in which there is a front and a rear propeller and the device may be of general application for use wherever a drive of this character is desired

TYPEWRITER HOLDER.—L. C. FOX Stevenson, Wash This invention pertains to adjustable supports or brackets, and has particular reference to a device adapted for supporting a typewriting machine upon a table or desk so that it may be swung around or housed out of the way when not in use

JACQUARD LINK FOR KNITTING MACHINES.—G C. L TISCH L. TISCH, JR., and J H TISCH, 348 Livingston St., Elizabethport, N J This invention relates to improvements in jacquard links, and the purpose is to provide an improved construction of link to that shown in Patent No 457 265 so as to overcome the more or less loose motion which results from wear

PROCESS OF PREVENTING MOLDING IN SHAPED TIMBER.—F M KENNEDY Clarendon Ark An object here is to extract hot sap from steamed timber by passing a piece of steaming hot timber between two revolving rollers of the machine. In the operation the wood passed is prevented from becoming moldy while it is being dried

SAFETY DEVICE FOR OPERATING SUBMARINE MINES.—G E. ELIA, Hotel de Crillon Place de la Concorde Paris, France The invention has for its object a device for the firing arm of submarine mines or torpedoes and serves more particularly to render this arm or lever insensitive to the force of the sea currents or to the explosion of adjacent mines by preventing it from shifting under the influence of friction or shock of the hull of a vessel.

AUTOMATIC SUBMARINE MINE.—G E. ELIA Hotel de Crillon Place de la Concorde Paris, France. An automatic submarine mine has been described in which the ignition cartridge is integral with the guide cylinder of the striker, which renders it necessary to dismount the whole of the percussion system in order to inspect or charge the ignition cartridge.

DYEING MACHINE.—C. P DELAHUNTY, care of Delahunty Dyeing Machine Co., Pittston, Pa. This improvement refers more particularly to a means for pumping the dyeing substances through the vat. A further object is to feed the dyeing and washing agents from the bottom of the vat through the materials that are to be dyed.

Prime Movers and Their Accessories.

MUFFLER.—A N RUSSELL and I G MASON care of Ticonderoga Machine Works, Ticonderoga N Y The intention here is to provide a muffler to be used in internal combustion engines, with a plurality of disks, spaced apart, with central openings and corrugations extending therearound, so that when the gases of combustion are directed between the disks by the members disposed in the openings, the expansion of the gases is retarded and the direction of flow of the gases is reversed at each corrugation, by which means the explosive energy is absorbed.

Railways and Their Accessories.

COMPENSATING TRUCK FOR RAILWAY CARS.—A. J. [illegible], Newberg, Ore. The intention here is to compensate for, or reduce to a minimum, the torsional strain to which the axles and bearings are subject, and to obviate invariable frictional and shearing actions of wheels and their flanges upon rails of curves in a line railroad, which occur through conditions wherein the outer wheels of a truck have a circle of a larger arc to traverse than that of wheels on the inner and consequently shorter circle, with the resultant slipping and grinding of the latter, and similar heavy friction and tendency to shear of the former

CAR FENDER.—J P GERAGHTY, 50 W Hamilton Pl., Jersey City, and G. W. NAYLOR, 53 Bayview Ave., Jersey City, N J For carrying out the purpose of this invention use is made of an apron frame mounted to turn and to slide on a support and connected with upwardly extending links for normally holding the frame in approximately horizontal position. The frame, on being moved rearward, causes the links to swing downward into receiving position.

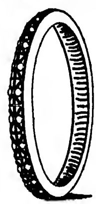
Pertaining to Recreation.

PIVOTAL SUPPORT.—S. W BRUNDAGE, care of C. W Parker, Leavenworth, Kan. The principal object of the invention is to provide a support for use in a variety of different mechanisms, being particularly designed, however to provide a pivotal mounting which may be easily and quickly dismantled. It is especially adapted for use on carousels or merry-go-rounds.

CAROUSEL.—H L. MILLER, care of C. W Parker, Leavenworth, Kan This invention relates generally to carousels, and is more particularly directed to a structure wherein the oscillating movement imparted to the figures is brought about through the medium of the overhead construction which carries such figures.

Pertaining to Vehicles.

TIRE.—MARY DAWSON, 417 Campbell Ave, Vancouver British Columbia Canada. The invention pertains to means for preventing punctures of the inner tube of a tire, and it is a design of the improvement to provide spaced



TIRE.

interior elements on the outer shoe, or otherwise so arranged to contact with the exterior surface of the inner tube in such a manner as to reduce the contact surface of the inner tube with the adjacent surface of the shoe or adjacent tire elements, whereby the inner tube will be less likely to be punctured.

Designs.

DESIGN FOR A STREET LIGHT STANDARD.—J McL. PETTYJOHN, 601 N 6th St., Terre Haute, Ind. In this ornamental design the column is supported by a small square base and its top is capped with four arms from each of which hangs a light globe The fifth and largest globe is poised upright on the center of the arms.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

PATENT ATTORNEYS

PATENTS

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IMPROVEMENT IN AEROPLANES No. 1,055,468. Rises from the ground without the initial forward movement, instantly stopped or started. Chas E. Johnson 408 Madison St. Topeka, Kan.

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READ THIS COLUMN CAREFULLY You will find inquiries for certain classes of articles numbered in consecutive order If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry may be repeated

MUNN & CO., INC.

Inquiry No. 9298 Wanted the names and addresses of concerns who can turn irregular shaped handles in wood similar to gun-stock work.

Inquiry No. 9299. Wanted name and address of the maker of a machine for driving fence posts into the ground.

Inquiry No. 9300 Wanted the name and address of a maker of a patented keyless door lock.

Inquiry No. 9301 Wanted the names and addresses of a few concerns who can do machine embroidery according to the design furnished, at reasonable rates.

Inquiry No. 9302 Wanted the address of the manufacturer of the Greenfield flexible armored conductors or cables. This is a double galvanized, spiral conductor or cable.

Inquiry No. 9303. Wanted the name of manufacturer who could make newly patented articles made from 12 to 20 gage sheet aluminum.

Inquiry No. 9304. Wanted the names and addresses of manufacturers of a second hand rug cleaning machine on the order of a carpet cleaning machine

Inquiry No. 9305 Wanted the name and address of concerns making paper letters and figures.

Inquiry No. 9306. Wanted small hardware and other specialties to be sold in notion and grocery stores. Wanted to buy wholesale.

Inquiry No. 9307 Wanted to buy a machine for honing and stropping safety razor blades on a commercial scale.

Inquiry No. 9308 Wanted woven glass fabric for manufacturing purposes in large quantities. The glass is spun.

Inquiry No. 9309 Wanted to buy small woven tubing of small diameter for use over the temples of spectacles where they go around the ears.

Inquiry No. 9310. Wanted addresses of manufacturers of good mining engines for small ore-bearing concerns to the trade of agents.

Inquiry No. 9311. Wanted names and addresses of manufacturers of brooms made of colored ... of all shapes.

Inquiry No. 9312. Wanted to buy a machine [illegible]

[illegible]

Agriculture, Electricity and Irrigation

(Concluded from page 472.)

except that both supply and demand for the current have increased.

Some of the farms in the vicinity of Visalia, Cal., are typical of the conditions suggested. The majority are small truck and fruit farms ranging from 10 to 40 (an average of about 20) acres to each person These farms may be termed electrically irrigated farms, for in practically all cases the farmers operate irrigation pumps by electricity, and the details of this class of electrical supply are well established.

In the State of Washington, we find similar interesting conditions where there is electric service for power and lighting use in all the newly settled farming districts.

We should study closely, all that has been projected in these great, electrically operated irrigation farms of America, for surely there can be no more important work for us in this day of agricultural investigation, than to apply in all sections of our country the principle of efficiency which underlies the utilization of our resources, exemplified by these illustrations.

During the primitive period of the history of American farming there was too much extensive husbandry and not enough intensive farming Land was abundant and cheap, and much of it drained itself The pioneer, believing the supply of land inexhaustible, selected a patch, killed off the trees, cultivated it until available plant life in the soil was exhausted, and then moved to another field. In this way, the increase in population being rapid, great inroads were made on the country's natural soil resources. In time, all the naturally drained and naturally watered lands were utilized, and a great portion exhausted, temporarily at least, and the reclamation of our western semi-arid and prairie land, along scientific lines, should be an object lesson to us all. Those lands are now rapidly being taken up and have become valuable Additional fertile, low cost farms, by the tens of thousands, are needed more and more as our population doubles.

We have learned from these western developments that for proper crop culture, all lands should be drained and all crops need water And it is not sufficient to have water by the deluge—from time to time—but water must be applied in such manner as to provide the stimulant necessary to plant life, in order that development may be greatest at certain stages of growth. This is especially interesting, in that it is a claim for the merits of irrigation, not only in the arid country, but in sections where there may be an abundant rainfall.

So it is seen that scientific agriculture, irrigation and electricity have formed a powerful combination. The natural waters are played with at will, sometimes passing directly to the land, but more often the turbulent mountain streams are carried for miles in flumes or canals, only to give up energy at several points on the way, and ultimately to irrigate the land by gravity, or pumping, as the conditions may require.

Another method is to drain the marsh land and pump the water thus available to the higher places adjoining. Suitable crops are then grown on land of any level, with the result that the area for production is materially increased.

Irrigation is the key which rejuvenates, as well as unlocks the fertility of the soil, and to comprehend its importance in agriculture, one must appreciate the fundamental principles governing plant growth and soil culture.

When we consider that all plant life must have moisture, and at certain stages of growth more water is required than at other times, it will be seen that to be able to control the supply of moisture places the growing of crops largely under the control of man. That is to say, we are thus able to aid the plant growth in a way that Nature does not do always.

Rain may or may not come when it is needed most, and again, it may pour down in destructive quantities, but water under a well-managed irrigation system is turned on when and where and to the amount desired. This makes farming in semi arid regions a more definite and scientific proposition than it is in parts of the country apparently more favored by Nature. And through the recognition of this fact, we are able to learn a lesson that holds good for all sections, namely, that when we have so arranged our soil conditions that water may be drained off the land as positively as it is applied, the application of irrigation methods is beneficial, no matter what may be the natural conditions of rainfall.

Pump irrigation means intensive farming. And this is the direction in which our eastern States' agriculture is moving. It may also be added that the power required for pumping has proven to be the opening wedge in introducing the use of electricity in the majority of those farming districts where dependence upon this form of energy has become established. The most scientific farming can be done only by electric pump irrigation, where the work can be programmed and the farm run just as systematically as some of our big manufacturing and commercial undertakings.

Many an eastern farmer can recall that he has watched the clouds float by, while wishing that rain might fall. The few irrigation equipments that have been experimented with in our humid sections prove conclusively that such anxiety may hereafter be avoided.

During the spring of 1911, the early strawberry crop of many eastern sections was completely destroyed by a six weeks' drought. Four acres of strawberries irrigated under an experimental plant in New Jersey, yielded the land owner between $400 and $500 per acre. The season's yield of New Jersey alfalfa was increased by irrigation at the rate of two tons of cured hay per acre, worth $25 per ton. Four acres of five-year-old peach trees responded to irrigation with $3,400 worth of fruit.

These results, according to the Government engineer, under whose direction the experiments were conducted, were obtained on a farm which has been cultivated for 250 years, on lands which have heretofore failed to yield sufficient returns to keep one boy out of ten on the farm, lands which heretofore have failed to yield sufficient returns to encourage the clearing up of thousands of acres of similar lands. Similar lands lie here at the very door of European immigration, untouched by the plow, within a few miles of 10,000,000 consumers, land which should be reclaimed and made the garden plot of this great multitude.

When we awaken to the large areas of dormant, latent agricultural possibilities that will come about through drainage of the low lands, coupled with a general practice of irrigation throughout our South and our East, much in the same way that water distribution has been conquered in our West, we will realize that here are many millions of acres to be added to the productive area of this country.

These are problems requiring immense work and study for years to come, but the beneficial results will outweigh many times the cost and labor that will be necessary to solve the problems. At present, an abnormal condition exists just as it did in the semi-arid sections before irrigation was introduced, and it is my belief that the reclamation of worn-out farms and barren lands of the Atlantic Slope now presents most remarkable agricultural opportunities.

Franklin Institute Treasures

(*Concluded from page 474.*)

principle and leaky and was ultimately abandoned. The model at the Franklin Institute is a working model, complete in every detail.

Brush's original arc lamp is given a place of honor in the collection. It is a very heavy contrivance, but in principle it differs little from the improved lamp of the present day.

There is a fine collection of water wheels in the exhibit, showing the early idea of the steam turbine of the present day. In the collection are overshot, undershot and breast wheels, including Parker's original percussion and reaction water wheels. The original testing machine made for the committee appointed to investigate the strength of materials can be seen at the Institute, several good architectural models showing buildings and bridges and the efforts made by past generations of engineers to overcome natural obstacles. Elihu Thomson's original electric welding device, demonstrated for the first time at the Franklin Institute in 1888, is on view, and also Outerbridge's process of giving iron a lace-like pattern from the use of lace itself, an odd method of ornamentation that is not the method in use to-day.

For those interested in the resisting capacity of the barrels of guns there is a varied assortment of burst barrels, showing how far a barrel can be driven without giving way. Tests were made by stopping the barrel of a rifle with clay, with sand, with mud and various other substances, and gaping holes in the metal show the danger of firing a gun with any obstruction in the barrel. Other exhibits show the strength of rifle barrels made by various nations. The amount of powder was augmented in each discharge until the barrel burst.

A corner that will interest many visitors is that given to the display of various typewriting machines of antique design. Some included in this collection were considered most satisfactory machines by men who are by no means old men to-day, but they are no longer manufactured. They are curiosities even among the collections of the second hand dealers, and some are probably not even to be seen there. The original bar lock typewriter is among them.

Among the odds and ends of curios may be mentioned the pneumatic carrier used when this feature of the postal system was first installed, a machine for barking trees, a Daguerreotype model camera made by Isaquin Bishop in 1839, camera and developing box complete, several models of the early printing telegraph, including Bain's original printing telegraph, a model of Godfrey's quadrant, made by James Ham in 1781, Emmons single track railroad, the original single track road of 1837, ice boats and ice crushers, canal boats with propellers, and a large collection of Franklin relics, including his bench for dressing type and his static machine.

There are nearly three hundred models in the collection, which has been brought from the dirt and obscurity of the Franklin Institute's cellars through the efforts of the secretary, Dr. R. B. Owens, assisted by Mr. Bullock. The models have been cleaned, repaired and classified, and all the working parts put in shape by skilled mechanics, a task requiring tremendous labor and not a little research, for some of the models could not be identified without considerable trouble and searching among the old files and journals of the Institute.

Registration of Patents in the Philippines.—The Philippine legislature has enacted under date of February 10th, 1913, an act which provides that owners of patents which have been issued or may hereafter be issued duly registered in the United States Patent Office under the laws of the United States relating to the grant of patents shall receive in the Philippine Islands the protection accorded them in the United States under said laws and that any infringement of such rights shall subject the person or party guilty of such infringement to the liabilities created and imposed by the laws of the United States relating to such matters, provided that a duly certified copy of all such patents shall be filed with the proper bureau or office of the Philippines, and it also provides [illegible]

spected in said territory the same as if such laws were in full force and effect.

Rehabilitating the Roman Campagna

A PROBLEM that has baffled the agriculturists of Italy for centuries—the rehabilitation of the Roman Campagna—seems now in a fair way of being solved.

The Campagna is a vast plain surrounding the city of Rome. Its soil is fertile, it is well watered, and the great city at its center offers a market for all that it can produce. Once it was densely populated and prosperous, but to-day it is a desolate wilderness. Not a tenth of its surface is under cultivation, it has no towns, but only a few scattered and ruinous wayside inns and the miserable huts of a handful of herdsmen and vine-dressers. Its deplorable condition is due entirely to the fact that throughout the summer it is a hotbed of malaria. In winter it is habitable, and then many herdsmen drive their cattle hither from the surrounding mountains to graze in the rich pastures, but in the month of May they return to the higher and more healthful land.

Even in ancient times the Campagna was not free from fever, but the presence of a large population kept the disease in check. In the light of modern knowledge this is explained by the fact that the land was kept drained, and there were few neglected places in which mosquitoes could breed. The depopulation of the Campagna was due to the incursions of barbarian hordes, and subsequently to the establishment of great estates in place of the small holdings of earlier times.

In the last half century many attempts have been made by the government and by philanthropists to colonize the Campagna from other parts of Italy, but until recently these undertakings have all failed, entailing immense loss of life. The government went so far as to decree the confiscation of large estates that should be left uncultivated by their proprietors. The latter made every effort not only to attract a peasant population, but to protect settlers from the dreaded scourge. At one time it was believed that the planting of eucalyptus trees would check the malaria, but this expedient, after being tried on a large scale, was found to be of no avail.

Since 1900 the Italian Red Cross Society has maintained stations in the Campagna for the treatment of the fever stricken people. About the same time the part played by mosquitoes in communicating malaria became known, and the screening of houses was advocated. The government immediately took steps to screen all police stations, military barracks, custom houses, and so forth, the railway companies screened their stations, and the landowners and the peasants themselves followed suit. However, the results of these efforts were disappointing. It was soon recognized that even those persons who took care to keep their window screens in place and their screen-doors closed—as many did not—were bitten by mosquitoes while performing their daily tasks out of doors. The screens enjoyed only a brief popularity and have now been generally abandoned.

Finally, through the efforts of Prof. Celli, director of the Hygienic Institute at the University of Rome, the government turned its attention to quinine. The value of this drug in the treatment of malaria had, of course, long been known, but its cost placed it beyond the reach of the frugal peasantry. The government decided to manufacture its own quinine and sell it at cost price. This step was followed by the passage of laws requiring the local authorities to distribute quinine free to peasants attacked by malaria, and the same obligation was imposed upon public contractors with respect to their laborers. Later the law was given greater scope, and the communes were required to furnish free quinine not only as a remedy, but also as a preventive whenever conditions appeared to warrant such action. The results of these [illegible] by the

health statistics of the Campagna, which show that between 1900 and 1906 the percentage of farm laborers suffering from malaria was reduced from 31 to 3.4. Since 1906 the number of cases has continued to diminish. Already the aspect of the Campagna has changed, and an era of agricultural prosperity seems to be at hand.

The Alpenglow

EVERYBODY who has sojourned among the Alps, or other snow-capped mountains, must have admired the gorgeous coloring of the peaks at sunrise and sunset. Watching the splendid spectacle from day to day, the attentive observer soon discovers that it is a complex phenomenon, varying greatly with the weather, and sometimes exhibiting certain peculiarities that, to the uninitiated, are decidedly mysterious.

In fine weather the following sequence of events may be noted. When the sun has sunk nearly to the observer's horizon, the peaks to the eastward begin to have a reddish or golden hue. This fades gradually, but in a few minutes, when the sun is a little below the observer's horizon, but the peaks are still bathed in direct sunlight, an intense red glow begins down the slopes and moves upward to the summits. This is identical with the rosy "twilight arch" that in clear weather rises from the eastern horizon as the sun sinks below the western, and it is bordered below by the blue shadow of the earth. Now, for a few minutes, the peaks are in the earth-shadow, their rocks and snows assume a livid appearance, aptly described by the inhabitants of the vale of Chamounix whence the phenomena in question are well seen on the summits of Mont Blanc, as the "teinte cadavéreuse."

Presently occurs the remarkable phenomenon known as "recoloration" or "afterglow." In Chamounix it is called "the resurrection of Mont Blanc." The peaks, from which all color had faded, again assume a rosy tint, but this time gradually, and without any sharp line of demarcation between the glow and the shadow beneath. The recoloration is by no means a daily occurrence—in fact, it is rather uncommon—and it varies greatly in appearance and duration. Sometimes it lasts until an hour after sunset, and it passes away from below upward. Very rarely a faint second recoloration may be seen. All these phenomena may be seen, in reverse order, at sunrise though they are less common then than at sunset. They are known, collectively, as the "Alpenglow."

The recoloration of the Alps has been variously explained, but there seems to be little doubt that it is due, at least principally, to the reflection from the peaks of the rosy glow which forms in the western sky after sunset, known as the "purple light," and which is sometimes intense enough to constitute a secondary luminous source. The diffuse appearance of the recoloration, as compared with the well-defined zone of rosy light that rests upon the peaks while the latter are still in direct sunlight, is explained by the broad expanse of the "purple light" as compared with the small disk of the sun. Sometimes the sky itself (i. e., the fine dust in the upper atmosphere) reflects the "purple light," giving rise to a "second purple light" for an observer situated at a suitable angle of vision. This, in turn, may be reflected by the mountains, giving the rare phenomenon of a second recoloration.

A rival explanation of recoloration, proposed by Amsler, according to which the phenomenon is due to a rapid change in the refractive index of the lower air, owing to cooling after sunset, is not now accepted, chiefly for two reasons, viz., it fails to account for the corresponding sequence of phenomena before sunrise, and it assumes stronger contrasts of temperature in the vertical than have generally been found to occur. It is not impossible, however, that the process described by Amsler may sometimes cooperate in producing the Alpenglow at sunset.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request

(12805) J B asks Inclosed find ten cents and a few leaflets of an instrument called the ——— and another the ———, which the makers claim to be a wonderful invention If you have anything describing this instrument in detail, as to how it works and how it is made send us such descriptive circulars as you may have or tell us where to get them. Should you not have such in stock send us a SUPPLEMENT on its nature pertaining as near the instrument as you possibly can. Also send us a new catalogue of late SUPPLEMENTS. A. We have recently had several requests of this sort. It is not to be expected that we should have any information upon the instruments such as are described in the circulars which you send us. The basis of all such apparatus is secrecy The only way one could find out what the instrument contains is to buy one and take it apart, perhaps finding *nothing* in it. We give no indorsement for anything of this sort. The list of diseases named in the circular includes those of the most various origin and cause several are germ diseases. They cannot possibly all yield to the same treatment. The old family physician who has come in for a generation and knows the constitution of your whole family for several generations is the man to prescribe for the family and will use no nonsense in his work He will know whether you need any secret apparatus for your cure that is, he will know that you do not.

(12806) C A H writes Inclosed you will find a picture of lightning The picture was taken about two o clock in the morning, with the shutter of the camera open as for time exposure. You will note the dark streaks in the picture. Will you please explain what caused them? The shutter was left open for perhaps two minutes. A The appearance of dark lines like lightning flashes upon a photographic plate which has been exposed for a picture of lightning is due to the occurrence of at least two flashes while the shutter was open, one after the other This is fully explained in an article in the SCIENTIFIC AMERICAN Vol. 107, No 9, price ten cents Your photograph is a good one but the phenomenon is very common and every year several such photographs are sent to us

(12807) W F A asks 1 Is the speed of sound constant for all pitches? A The whole subject of the velocity of sound under various conditions is treated in Barton s ' Text Book of Sound price $3 25 postpaid It is there shown that within the whole range between Ut_1 and Mi_4 the speed of propagation does not alter by 0 1 per cent Tynda l in his classic work on sound cites the instance of the firing of a gun in the Arctic regions when the report of the gun was heard before the command of the officer to fire This would indicate that a pulse or shock upon the air traveled faster than a prolonged tone 2, If there should be no apparent discrepancy does this exclude *very slight* variation due perhaps indirectly to change of vibration number? A. The cause of the slight difference noticed is not stated

(12808) M S asks I would like to know if you could tell me whether there are any laboratories (chemical or biological) or laboratories belonging to large manufacturing companies which employ boys (16 to 18 years) for making tests on different materials or substances, setting up and cleaning up apparatus? A. There is doubtless just such a place as you describe somewhere and for some one who finds it. But we do not know where nor how to find it. There are not many such anywhere. In most places a young man is wanted who has had a good course in chemistry or in the branch of work in which he will have employment. A course of education is necessary nowadays for one to make a start in life with much prospect of a rise or of getting to the top in time. Conditions are changing and the young man must be we l trained before he sets out to work in any skilled employment.

(12809) L. A. McC 1 Will you tell me, through the Notes and Queries column, if I can grind convex lenses without the aid of expensive instruments, and if so, how? A. Lens making is not simple and easy work, but many amateurs have succeeded well by painstaking and persistent work. You will find the necessary instructions in Orford's "Lens Work for Amateurs,' price 80 cents postpaid. The apparatus required is not expensive. 2. What is the probable average temperature of the equatorial region of Mars? If this temperature is below the freezing point of water, how do the astronomers explain the "canals," since ice cannot flow? A. It is generally supposed by astronomers that the summer of Mars is warm enough for vegetation and that the canals are filled with water, with crops growing on their banks. The polar caps disappear as summer comes on, just as they would on the earth. It is believed that they are ice and snow melting in the spring months. 3. Is the theory, which I heard [illegible]

NEW BOOKS, ETC.

BAU UND BETRIEB VON PRALL-LUFTSCHIFFEN Von Richard Basenach II Teil Allgemeine Darstellung des Entwurfs und Konstruktion Munich und Berlin Verlag von R Oldenburg, 1912

This second volume of Basenach s book on non-rigid airships discusses the subjects of lifting capacity and the determination of the important points of the gasbag such as the centers of buoyancy of displacement and of gravity The author has thoroughly considered the stresses which are set up in the fabric of the envelope and of the influence of internal gas pressure and of the load to be lifted Taken together the two volumes by Basenach may be regarded as a very clear and excellent text-book on an important phase of aeronautics.

MECHANISCHE GRUNDLAGEN DES FLUGZEUGBAUES Von A Baumann Teil I und II Munich und Berlin Verlag von R Oldenburg, 1912

The two volumes by Baumann on the mechanical foundations of flying machine construction are remarkably good, partly because they give an immense amount of practical information with the aid of very simple mathematics and partly because they include a discussion of the practical application of the more recent aerodynamic researches. The author promises us a third volume, in which the stability of flying machines will be taken up

MODERN ORGANIZATION An Exposition of the Unit System. By Charles De Lano Hine New York The Engineering Magazine Company, 1912. 12mo, 110 pp Price, $2

Emerson with his efficiency staff and Taylor with his functional management, have each developed systems of internal economy that have been applied widely and with most marked and satisfactory results. Major Hine here gives us a third mode of bringing line and staff into harmonious relationship a mode in which each department head becomes at the same time special staff counsel and active line officer thus extending his sense of responsibility to the efficiency of the whole organization while retaining it for his own department This result is brought about by the subtle influences surrounding the introduction of a new viewpoint and minimizes the disturbances and the positive antagonisms which decided physical changes almost always produce No cumbersome machinery is brought into use The unit system is in successful operation on the Harriman lines. It is well worth the consideration of all organizers and managers and its plan for the correction of over-centralization and over-specialization seems as applicable to manufacturing and industrial organization as to that of transportation

THE DESIGN OF STEEL MILL BUILDINGS And the Calculation of Stresses in Framed Structures By Milo S Ketchum, C E New York McGraw-Hill Book Company, 1912 8vo, 562 pp, 270 illustrations Price, $4 net

This third and enlarged edition of Prof Ketchum s Steel Mill Buildings is noticeable for the care and the expert knowledge that characterizes all his books In it he deals with dead snow wind and miscellaneous loads with stresses in framed structures roof trusses portals, arches and beams design is presented under the captions—Framework Corrugated Steel Roof Coverings, Side Walls and Masonry Walls, Foundations Floors Windows and Skylights Ventilators, Doors Shop Drawings and Rules, Paints and Painting Estimate of Weight and Cost. There is a section devoted to miscellaneous structures, and appendices dealing with specifications, with problems in graphic statics, and with structural drawings estimates and designs.

COST REPORTS FOR EXECUTIVES. By Benj A Franklin New York The Engineering Magazine Company, 1913 8vo, 149 pp Price, $5

In cost accounting as in all pursuits involving a mass of figures and a daily routine, what is intended merely as means to an end not infrequently becomes the end itself When the significance of the imparted facts becomes lost in the labor of their collocation and presentation cost accounting defeats its own purpose. Mr Franklin opens the blinded eye and very clearly shows executives of manufacturing plants what they ought to expect of their cost system, and how to increase and to retain its vitality and usefulness.

MOTION PICTURE WORK. A General Treatise on Picture Taking, Picture Making, Photo-Plays and Theater Management and Operation. By David S. Hulfish Chicago American School of Correspondence, 1913. 8vo, 297 pp.; illustrated

The time is ripe for the appearance of such a work as this, which exhaustively presents the details of a new industry employing thousands of people and offering recreation and education to millions more. Whether the reader is interested in the manufacturing or the exhibition end of the business, he will find here full information upon any point he may be desirous of learning. The construction, installment and operation of the theaters is most fully dealt with, and gives descriptions of the various machines and methods with a wealth of illustration. The actual picture-taking is described in another large section of the volume, and specifically presents the necessary conditions for producing images of the scenes or objects, for recording this image in permanent form, and for [illegible]

SIXTY-NINTH YEAR

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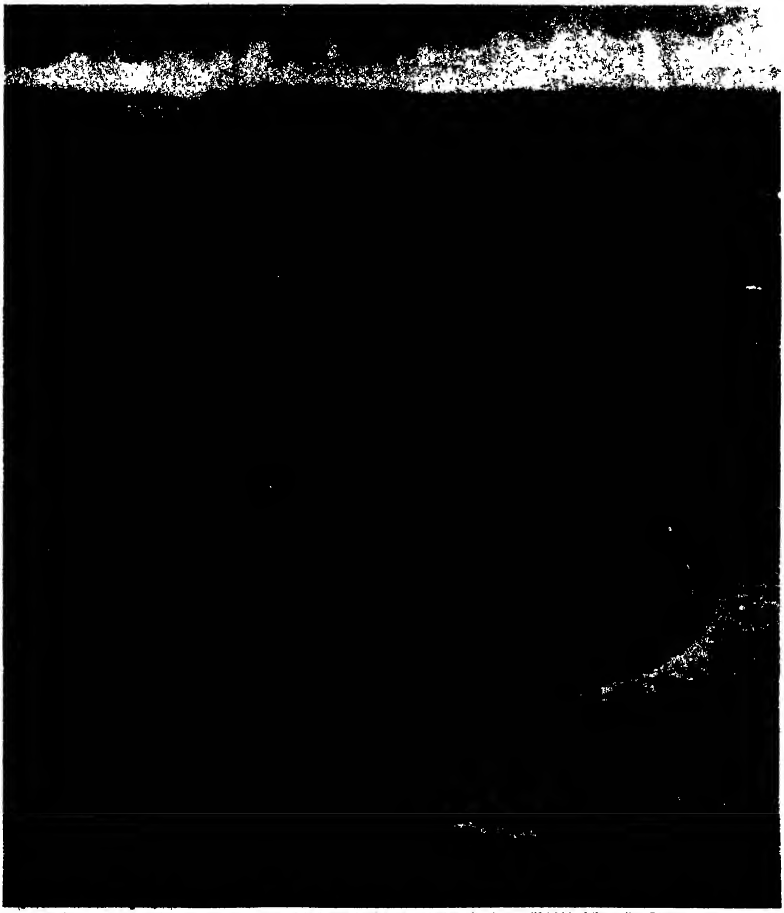

It is proposed to carry a large part of the sewage by a tunnel 10 feet in diameter under the lower bay to an artificial island three miles offshore, where the solids will be removed and taken out to sea in tank steamers and the liquids will be rendered harmless before being discharged

PLAN FOR THE DISPOSAL OF NEW YORK'S SEWAGE.—[See page 496.]

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Munn & Co, Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are sharp the articles short and the facts authentic the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement

Science and the Cost of Living

WE are well accustomed to the truism that all science ultimately finds practical application but we do not always equally realize that all practice has a scientific basis. Approach the average business man on the subject of the theory of wealth, and he will probably wave you aside with the statement that he is too busy with the practice of producing values to pay much attention to theories, however pretty

This may be all very well for many purposes empirical methods and rule of thumb often answer well enough But in a problem of national and international importance we can not afford to proceed by cut and try methods when science clearly points the way to him who will listen

Everyone is keenly interested in the phenomenal rise in the cost of living which has taken place within the last sixteen years—a rise of no less than 50 per cent? And so everyone deems himself qualified to account for the phenomenon. Each naturally sees the cause of the condition in some circumstance that happens to be his pet grievance—the tariff the trusts trades unions the introduction of machinery, or whatever it may be

The futility of some of these attempts at explaining the situation is perfectly obvious to one who has made an unbiased study of the facts Our tariff can evidently not be the cause of a condition which has been observed equally in England France Germany and elsewhere as well as in our own country as is clearly shown by Prof J P Norton in an article "The Changing Cost of Living, in this week's issue of our SUPPLEMENT

As a matter of fact, the theory of currency furnishes an explanation which is as simple as it is convincing Yet few people had, until recently taken note of this simple truth It was first pointed out by Samuel Newcomb that the purchasing power of an ounce of gold (supposing for the sake of simplicity that all purchases are made in gold) depends on two factors first, the total amount of gold in circulation, and secondly, the rapidity of circulation To quote A Del Mar ("The Science of Money") "Suppose that 150 000 million dollars worth of exchanges are to be transacted in a year, and suppose the only kind of money to be used consists of gold dollars. If these dollars could be used but once during the year, it follows that it would take 150000 millions of them to effect the exchanges If they could be used and re-used fifty times a year 1000 millions of them would suffice to effect the exchanges," that is to say the purchasing power of the ounce of gold would be fifty times greater than in the preceding case

If, then the purchasing power of gold thus depends on these two factors, the total amount of gold in circulation and the rapidity of circulation, we must expect that any marked change in either of these factors will be accompanied by a corresponding change in the price of commodities The rapidity of circulation is subject to seasonable fluctuations, owing to the effects of the seasons upon trade and agriculture and the "price of money" fluctuates accordingly Again, the total amount of gold in circulation has been increasing steadily for many years, as the output of the world's gold mines is many times greater than the loss of gold incidental to commerce and industry This must necessarily bring in its train a fall in the purchasing power of gold, or, what amounts to the same thing, a rise in the cost of living, all the world over No local legislation of any kind can possibly stem the tide, any more than we can hope by man-made laws to overcome the action of gravitation.

The fact that this simple fundamental law of the theory of currency was discovered by an astronomer and mathematician, and remained unnoticed by the bulk of "economists" for some twenty years, until unearthed and brought into the light by Profs. Kemmerer and Irving Fisher, carries a moral of its own. The non mathematical is often inclined to speak somewhat flippantly of the "formulæ" of the mathematician. No sneer was ever more utterly misplaced than this. No problem can be said to be completely solved until it has been cast into mathematical form. And many a "scientific" controversy rages for years, simply because the contestants have not sufficient mathematical judgment and training to count the number of variables involved in a problem, and the number of independent equations connecting such variables. So long as the former number exceeds the latter, the problem is necessarily indeterminate, and there are a number of possible solutions A number of persons who, unaware of this, each insists on a solution of his own selecting, may evidently go on arguing forever without coming to an agreement. This is what is apt to occur in a branch of science where the mathematical method of treatment is neglected or even despised.

Cold Light

THE invention of Prof C F Dussaud, described and illustrated on another page in this issue, once more attracts attention to our present methods of illumination Between the glow worm and the incandescent lamp there yawns a gap which will some day be bridged by the combined aid of the physicist, chemist, engineer, and metallurgist. The luminous creatures of nature considered as lighting machines, operate at an efficiency of about ninety five per cent The best incandescent lamp of the day has an efficiency of about two per cent Clearly, we have still much to learn from the firefly

It is only within the last ten years that this problem has been systematically attacked. At least a score of highly trained scientists on this side of the ocean alone have applied themselves to the task of improving our methods of illumination The new profession of "illuminating engineering" has been created—a calling which is followed by men who have studied the art of distributing light most effectively Psychologists, even, have been recruited in the effort to provide us with cheap and satisfactory artificial light for it is now recognized that much of the world's work is done at midnight and that the human eye, the most delicate and responsive organ of the entire body, cannot be recklessly overtaxed

In this systematic study of illumination much has been discovered which has encouraged the laboratory workers. A spectroscopic study of the firefly's light by Drs Ives and Coblentz, along the lines long ago laid down by Langley, has shown that the intermittent flashes of the insect are spectroscopically akin to the radiation of the mercury vapor arc. Both lights are greenish yellow, or yellowish green Of all the radiations in the spectrum the yellowish green portion is luminously most efficient Hence the mercury arc in a sense is a continuously glowing artificial firefly of glass and mercury vapor, and hence man has been unwittingly following in nature's footsteps.

Encouraging as this is, it is doubtful if a light as cold as a luminous insect's will ever be really attained. Indeed, it may be doubted if we want the artificial equivalent of a firefly Because the mercury arc radiation is decidedly unpleasant a gigantic firefly's luminosity would be no more agreeable It is absolutely certain that light must be white, that it must not interfere too seriously with the judging of color values. Hence a slavish imitation of the firefly, a mere striving after a cheap and efficient light without regard to æsthetic requirements will be fruitless. It seems inevitable, that for this reason alone, heat must always be an attendant of light

The Embroidery of Knowledge

ONLY one who has lived much among old books realizes the æsthetic poverty of contemporary scholarship compared with the scholarship of some generations ago. Two criteria appear to be all-sufficient in determining what we shall learn nowadays, whether in or out of school. First, is it useful? Second, is it true? Once there was a third Is it beautiful? Or, to express more completely the ideals of our grandfathers Is it picturesque, piquant, romantic, colorful, spiritually enriching?

As to what constitutes utility, opinions will always differ, but between truth and falsehood the line is sharply drawn. Now, the ultimate criterion being the happiness of the human race, is there not much untruth that is worth while? In all ages there have been ascetic schools of thought that returned a formal negative to this inquiry, and modern pedagogy appears to have tended toward the same view

More years ago than we care to specify, we learned the constellations. Even then the fashion of putting mythological figures on the star-maps—and *a fortiori* of teaching mythology along with astronomy—was on the wane, but by a chance, for which we have never ceased to be thankful, old Burritt fell into our hands. We learned the stars—and how much besides! How much, moreover—and this is the point we are aiming at—of which the modern youth commonly learns nothing. All mere embroidery, if you like—but how beautiful, how entrancing, how well worth cherishing through life! Old Orion brandishing his club at the Bull, the mild Bear sedately pacing around the pole, careless of the Hunting Dogs at his heels, the jeweled locks of Berenice, the Swan soaring down the Galaxy, and all the rest of that splendid company that still, for us, peoples the nightly sky, but is invisible to many astronomers who know a great deal about Besselian numbers and other "true" and "useful" things. Of course, one can and does learn mythology without the stars—whether from the fountain-head in Homer and Hesiod and Ovid, or from some short-cut of modern devising—but how much the myths and the stars enhance each others' charms, and how much the world is losing in their conjoined spell!

And so of the flowers, their legendry, their embroidery, is even more conspicuously neglected than that of the stars. What modern teacher of botany thinks it necessary or expedient to instruct his classes in the history of herb-lore—to show them copies of the old herbals—to explain the quaint doctrine of "signatures"? What does the youth of to-day know of the curious beliefs enshrined in scores of familiar plant names? To be sure, such knowledge, like a knowledge of star-lore, is absolutely essential to an understanding of thousands of allusions in world literature—in Shakespeare, Dante, Tennyson, Rostand—and hence to a full enjoyment of such literature, but apparently this fact does not make it "useful" according to Philistine modern standards.

As to history, happy is he who learned picturesque fables along with sober truths from Goldsmith's histories of Greece and Rome. We fear hardly a school boy of the present generation (apart from the dwindling few who still read Plutarch) can tell who it was that said, on a certain memorable occasion, "Strike, but hear me!" or has ever so much as heard what answer Leonidas made to the Persian monarch when summoned to deliver up the Spartan arms at Thermopylæ

You who know only jejune, matter-of-fact modern textbooks and reference books—spend an afternoon in some old library, with Rees's Cyclopedia and the Oxford, with Lempriere's Classical Dictionary ("readable if not very trustworthy" the Britannica calls it), with a score of old books on "natural history" and "natural philosophy," and, above all, with some files of the old periodicals. You cannot fail to be impressed with the fact that, with all its intellectual and material gains, scholarship has lost much in grace and distinction and humanity What is more remarkable—and here is a hint for the practical and prosaic reader—these old books contain an astonishing amount of substantial and authentic information that has, somehow, dropped out of sight in the hurly burly of "progress."

Hereditary Effect of X-Rays

EXPERIMENTS in applying X rays to the ovaries of animals show that these are extremely sensitive to the rays, and are modified more strongly than is seen in any other tissue. Recent researches made by M. Fraenkel in Germany appear to show that such modifications are transmitted to the next generation, so that we have a transmission of acquired qualities in this case. He applied the rays for half an hour upon a four-day old female guinea pig, and found that in the subsequent growth of the animal the development in size and weight are strikingly lessened as compared to check specimens, 570 grammes as against 725 at the age of 10 weeks. However, the reproductive faculty is not diminished, and the female gave birth (after the normal period of 9 weeks) or at the age of 20 weeks, to three young, one dead and two living, but strange to say, the young had an extremely small size and kept a smaller size than normal during their growth. Again the reproductive power is not lessened. These animals were not exposed to the rays. The female having 7 inches length, gave birth to two young, one dead and the second of extreme weakness and needing a nursing bottle feeding. The mother also had a second litter of three young, but all very small, after which she could no longer reproduce, as the organs, altered by the X-rays, seemed to have their vitality exhausted.

Engineering

The New German Dreadnought "Grosser Kurfuerst" was launched at Hamburg on May 5th. This vessel is a sister-ship of the "Koenig," launched March 1st. The new dreadnought has a displacement of 27,000 tons, and will be armed with ten 14-inch guns.

Lipton's Challenge for "America's" Cup Accepted.—The challenge of Sir Thomas Lipton, of the Royal Ulster Yacht Club, has been accepted by the New York Yacht Club. The races are to take place under the New York Yacht Club's present rules of measurement, time allowance and racing, in September, 1914.

British Gun Record.—It is reported that the British super-dreadnought "King George V" has made a record of 39 hits out of 40 rounds fired with its 13.5-inch gun The American record for big guns is held by the battleship "South Carolina," which in 1910 made 54 hits out of 57 shots with 12-inch guns. This is a record of 94.7 per cent, as against 97.5 per cent of the "King George V" No information as yet is available as to the range under which the British record was made

Nine Years of Work on the Panama Canal.—A report has recently been published marking the completion of nine years of work at the Panama Canal under American jurisdiction Little actual work was done for the first three years. Now 99 per cent of the concrete work has been completed, and only 20,000,000 cubic yards of dirt are still to be excavated The total expenditure so far has been $290,110,000 Excavation is proceeding at the rate of 2,500,000 cubic yards per month

To Deepen the Buttermilk Channel.—In order to provide adequate access to the New York Navy Yard, it has been decided to deepen the Buttermilk Channel between Governors Island and the Brooklyn shore to 40 feet, and increase its width to 1,000 feet. At present it is proposed to dredge it to a depth of 35 feet, which will cost $1,950,000 Later 5 feet more will be excavated, at a cost of $3,350,000 The reason for favoring this route, instead of the one now in use around the northwestern side of Governors Island, is that the latter would involve the removal of two rock ledges, which would be a difficult and dangerous task owing to the congested condition of shipping at this point This deeper channel is called for by the increasing draft of our dreadnoughts

Opening the Pacific End of the Panama Canal.—The dike south of the Miraflores lock, which has kept the waters of Ancon Harbor out of the Panama Canal during excavation, was destroyed by a blast of 32,750 pounds of dynamite on May 18th This let the waters of the Pacific into the canal It was originally planned to continue the excavation back of the dike with steam shovels, but as the dredges at the Pacific entrance had practically completed their work they were available for operation in the canal itself The dike was accordingly destroyed to admit them As excavation with dredges is more expeditious than steam-shovel work, this will make for increased progress Although the canal will not be officially opened until January 1st, 1915, it is probable that ships will be able to make the passage through it early this fall The only element of uncertainty is due to the slides at Culebra. Were it not for these slides there would now be only a million and a half cubic yards to be taken out of the cut instead of six and one half million cubic yards.

Naval Fire Control.—The daily press has been thrown into a high state of excitement over the theft, last March, of the fire-control plans of the dreadnought "Pennsylvania," believing that vital secrets have been stolen to be sold to a hostile power Secretary Daniels' statement that these plans will be of practically no value to an enemy has failed to allay the excitement. The following reasons for considering the matter of trivial importance are given by Capt. William F Sims, of the U S. Navy, in a letter to the New York *Times*

1 "As a matter of ordinary every-day common sense, there are no wholly essential fire-control instruments or wiring in any battleships in the world that are not below the protective deck, under water, and behind very heavy armor

2. "All the exposed wires on the masts and elsewhere are aids to fire control, but are in no sense essential They are for the purpose of facilitating and accelerating the transmission of orders, which orders can, however, be sent with nearly equal efficiency without them

3. "The wires necessarily extend nearly the entire length of the vessel, so that there can be no special vital point for the enemy to attack

4 "There are not, and never can be, marksmen possessing such supernatural powers as to be able (with such information) quickly to direct a shot that would disable a ship and make it impossible for her to direct her fire.

5. "Even supposing the marksmen to be entirely accurate in their aiming, and the fire-control officers to be equally accurate in their estimate of the distance, the speed and course of the enemy, the effect of wind, etc., there are no guns (including the powder, shell, rigidity of mount, accuracy of sights, etc.) capable of performing such a miracle of precision in shooting at battle ranges, that is, at distances of from five to six statute miles."

Electricity

Power Plants on the Weser.—Quite an extensive scheme is on foot to use water-power from the Weser and other streams so as to operate three electric stations and distribute current over an area of 2,500 square miles, reaching a population of 600,000 The total cost of the enterprise figures at $2,000,000 and over Dams are to be erected across the streams at Eder, Münden, and Helminghausen for supplying the three turbine plants at these points, and all these plants together with their substations will be inter-connected upon the same network of power lines.

Turning a Sewer Into a Passenger Subway.—A somewhat unique example of "subway" electric line is found in the Paris sewers Here the tunnels are of unusually large size and, as is well known, they afford a considerable passageway, carrying large water and gas piping on roof and sides as well as electric cables of various kinds A recent idea has been to install a small electric road in one part of the tunnel so as to carry men and material The miniature cars are drawn by a front motor car which works by a trolley from a pair of wires run along the ceiling, and quite a train of the small cars is taken in this way

Electrification of the Berlin City Belt.—The Prussian Minister of Public Works, Herr von Breitenbach, expresses himself in favor of the proposed electrification of the Berlin city belt and suburban railways, for the traffic has now doubled on these lines within the last twenty years, and steam traction is no longer adequate to handle the traffic. Electric drive would give practically double the number of trains per hour, besides securing all the well-known advantages of the electric system. The Prussian parliament recently voted a credit of $5,000,000 for carrying on preparatory work upon this important scheme

Railroad Time by Wireless.—The North Railroad Company of France uses the Eiffel Tower wireless time signals in setting its station clocks at Amiens and Boulogne and the important center of Rouen The new system is superior to that of the telegraph, besides it does not temporarily monopolize telegraph lines Each day at 10 45 A M the employee at the small wireless post of the depot receives the tower signal and regulates his clock accordingly From this clock the other clocks on the premises are regulated A new portable wireless receiver contained in a small box is specially designed for taking the tower signals, two wires stretched between telegraph poles serve as antennæ

Explosion of a Generator.—From some unknown cause, the dynamo of a steam-turbine group blew up in the Essen station and made considerable havoc on the premises. The group in question consisted of a Zoelly steam turbine working at 1,000 revolutions per minute and direct coupled to a 5,000-kilowatt alternator The whole machine burst, throwing pieces in all directions, one piece weighing several tons went through the wall and damaged an adjoining building Other heavy pieces of 2,000 pounds weight were thrown through the roof, while the dynamo room was scattered with fragments All the damage appears to have been done to the buildings and not to the machines of the plant. No one was injured, fortunately

Stephen Dudley Field, known as the "father of the trolley," died at his home in Stockbridge, Mass , on May 18th, at the age of 67 He was the nephew of Cyrus W Field, who laid the first Atlantic cable His first work with the electric car was in 1880 when he built an experimental line on his own grounds in Stockbridge. His car took current from a central third rail He also took out patents on conduit and trolley systems One of his earliest inventions was the hotel annunciator, the first one of which was installed in the Palace Hotel, San Francisco, in the early sixties In 1874 he produced the multiple call district telegraph box, and in 1879 created a revolution in telegraphy by the introduction of the dynamo The following year he developed the dynamo quadruplex telegraph, and in 1909 he applied his system to the cable between Key West and Havana. He was also active as a pioneer in long-distance telephony and electric lighting

"Electrokali," a New Artificial Potash Fertilizer.—A Swedish electro-metallurgist, Axel Lindblad, one of the constructors of the Trollhaetten furnaces for the manufacture of nitrates, has just succeeded in producing a new potassic fertilizer which is capable of replacing the Stassfurt salts which are at present imported into Sweden at an annual cost of about $2,000,000 It is obtained by treating feldspar or some other mineral having a potash base in an electric furnace, together with suitable quantities of carbon and iron The resultant products are ferro-silicium, which can be used in steel works and foundries, and a potassic scoria which is readily soluble in water To prepare the latter for use it is only needful to crush it in a suitable mill and there sift it. Experiment proves that it is readily assimilable in all soils. It possesses the advantage over Stassfurt salts that it contains no chlorides, which are said to be injurious in some soils. It is also recommended for use in the manufacture of salts of potassium and aluminium.

Aeronautics

A Record Altitude Flight with Six Passengers.—On May 8th, at Chartres, France, aviator Frangeois carried six passengers in his biplane for an hour and a quarter in a Savary biplane During the flight he rose to an elevation of 2,300 feet, which is a far greater height than has been reached before by a machine carrying this number of passengers The duration of the flight also constitutes a new record

A New Flying Boat Record by Naval Aviators.—On the 9th inst , a new endurance record above water, when flying from point to point, was made by Lieut. J H Towers and Ensign G de C Chevalier in a Curtiss flying boat. Starting from Washington they followed the Potomac River and Chesapeake Bay to Annapolis, 160 miles away Three hours and five minutes were consumed in making this flight and the machine was kept at an average altitude of 1 500 feet

A Flight with Passenger from Bremen to London.—On Sunday, the 11th inst , M Brindejonc des Moulinais flew from Bremen to London—a distance of about 450 miles—at a high speed He left Bremen at 8 40 A M on May 9th, and flew to Calais The flight from the French port was made on the afternoon of May 11th M des Moulinais rose to a height of 5,000 feet and crossed the Channel in twenty minutes which is a record From Dover to London he maintained a height of 3,000 feet He flew directly over the city, despite the regulations to the contrary, and landed at Hendon aerodrome at 3 P M , thus again demonstrating the facility with which one can travel by aeroplane from country to country, despite all rules and regulations forbidding this A few days later M des Moulinais was haled to court and fined for having flown over London

A Record Flight Across the Alps.—For the third time the Alps were crossed on the 13th inst by an aeroplane In this case, however, it was the Bernese Alps which were flown over by Oscar Bider the Swiss aviator, in his monoplane Starting from Oberinnental in the canton of Berne, Switzerland, Bider circled about until he reached a high elevation and then flew directly across the Rawil Pass at a height of 3 200 meters (10,498 feet) He was two and one quarter hours flying the fifty miles to Sitten, which is in the canton of Valais Practically the entire flight was above the snow-covered mountains and glaciers and Bider was so cold and exhausted at the finish that friends had to lift him from his machine The entire flight, including the alighting at the end, was made without any mishap

An Oversea Aeroplane Race from Key West to Havana.—For a prize of $10,000 offered by the Cuban government, two Cuban aviators attempted to fly from Key West to Havana, a distance of about 100 miles on May 17th Despite a strong wind, Domingo Rosillo started at 6.35 A M in a Moisant monoplane and successfully accomplished the flight in an hour and a half He then flew over the city for another quarter of an hour before he alighted His machine was not provided with floats and the flight was one of the most daring ever reported A Cuban cruiser and two gunboats patrolled the course and were stationed some twenty-five miles apart Rosillo's competitor, Augustine Parla, was unable to start in his Curtiss hydro-aeroplane because of some damage to the machine, but two days later he also made the flight successfully and won thereby a second prize of $5,000 These flights appear to give promise of a successful long-distance transatlantic flight by having stationed, on a designated line of latitude about three hundred miles apart, a series of floating relief stations in communication by wireless telegraphy, by which the progress of such a flight could be reported and succor given in case of accident

A Somersault in the Air.—An occurrence which seems incredible, but which is vouched for by three prominent French officers, is recounted in *Aéronautics* This is nothing more or less than a somersault in the air which befell Capt Aubry when flying a Deperdussin for the purpose of effecting a reconnaissance over the region of Villerupt. "I was returning after a 35-minute flight," the Captain assures us, "facing a wind of about twenty-two miles per hour My altitude was about 2,500 feet At the moment of descent a series of violent gusts struck the machine, and on throttling down and switching off, I was obliged to dive in order to make the controls effective As I dipped the nose of the machine, a couple of quick, successive gusts struck the top of the main planes and placed me in a vertical position While endeavoring to manipulate the elevator I found the machine had taken me in a perfectly vertical chute to less than 1,500 feet. It here adopted a horizontal attitude upside down and proceeded to effect a tail-first *vol plané*" Somehow the pilot retained his seat Continuing, he says, "The machine then gradually took up the vertical position again describing a gigantic 'S' while doing so Flattening out, I flew to a spot about two miles distant."

A Hydraulic Variable Speed Gear

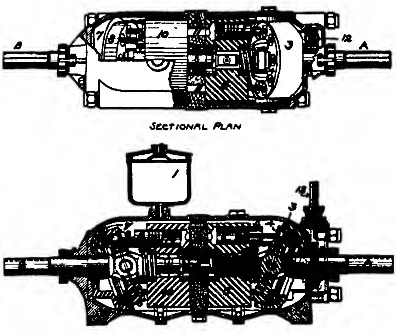
A Power Transmission Mechanism Consisting of a Pump and Engine Couple

SEVERAL years ago a new type of speed gear was experimentally installed on one of our battleships for controlling the elevation of a 12-inch gun. The gear proved so successful that now more than five hundred of these machines are being used by the United States Navy. For a while the speed gear was kept quiet, but eventually the news leaked out, and the machines were sought by European powers as well. Now they are being built in England, France, Russia, Italy and Japan. Broadly, the gear consists of two main parts, an oil pump, and an oil engine operated by the fluid set in motion by the pump. The speed of the oil pump is constant, but the stroke of its pistons may be varied at will thus varying the flow of oil to the engine and correspondingly varying the speed of the oil engine. The stroke of the piston is varied by operating a control shaft, and because the fluid used is practically incompressible and the leakage between pump and engine is on the average 17/100 of one per cent, the speed ratio between the pump and engine is positive and definitely determined by the angular position of the control shaft regardless of the amount of power that is being transmitted.

The operation of the gear may be understood by referring to the accompanying line drawings showing a sectional plan and a sectional elevation of the gear. The pump end of the gear is marked with the letter *A*, while the engine end is marked *B*. Accordingly, the *A* shaft is the driving shaft, while the driven shaft *B* is at the opposite end. The entire gear is inclosed in an oil tight casing, and is provided with an oil expansion box 1. With in the casing two chambers are formed by a partition 2, known as a valve plate. At the *A* end of the casing is a tilting box 3, in which is mounted a socket ring 4. The box 3 does not revolve, but serves as a guide for the ring 4, giving it a wabbling or gyratory motion as it is carried around by the shaft *A*. The amount of the gyration can be varied by tilting the box 3. A series of nine pistons 5 are connected to the socket ring 4 and are made to play in and out of the cylinders 6, as the ring 4 gyrates. Of course the cylinder barrel 6 revolves with the shaft *A*. It will be evident that the stroke of the pistons 5 will depend upon the angle of inclination of the box 3. If the plane of the box is normal to the shaft *A* there will be no gyration of the ring 4, and consequently no reciprocation of the pistons, and if the box is tilted past the normal the pumping will be reversed.

The engine mechanism at the opposite end of the gear is quite similar to the pumping mechanism, except that in place of a tilting box there is a box 7 set at a fixed angle equal to the maximum angle of inclination of the box 3. Mounted to turn in the box 7 is a socket ring 8, connecting with a series of pistons 5, that operate in the cylinders 10. The cylinders 10 at the pumping end are supplied with oil from the cylinders 6, through ports 11 in the valve plate 2. It will be evident that as half of the pistons 5 are moving inward the other half are moving outward, so that when the gear is transmitting power one of the passages 11 is under pressure, while the other is in suction. If the angle of inclination of the box 3 is equal to that of the box 7, the engine cylinders 10 will be filled and emptied at a single stroke of the opposite pump pistons 5. As the engine cylinders are filled and emptied their pistons 9 are reciprocated and as they push the inclined ring 8 against the box 7 cause the ring to revolve and carry with it the shaft *B*. Thus the power transmitted from the *A* to the *B* shaft will undergo no change of speed. However, as the control shaft 12 is operated to tilt the box 3 more and more toward the vertical position, the stroke of the pistons 5 will be reduced and it will take more than one stroke of a piston 5 to move a corresponding piston 9 out to its full extent. Thus the shaft *A* will have to make more revolutions than the shaft *B*, and the ratio will increase as the control shaft is operated, until the box 3 is moved to vertical position, when the stroke of the pistons 5 will be reduced to zero, and the shaft *B* will remain stationary, although the shaft *A* is still running at constant speed. If the control shaft 12 is still farther operated, the box 3 will be oppositely inclined and the pistons 5 will again begin to reciprocate, but those which were formerly moving inward at one side will now be moving outward. So that the port 11, which was formerly under compression, will now be under suction, and vice versa. This will result in reversing the motion of the shaft *B*. The oil within the casing of the gear is under no pressure, but merely serves to lubricate the parts. The only pressure is that which exists between the pump and engine cylinders, and the design is such that there is practically no leakage between the cylinder barrels and the valve plate 2 except enough to provide a lubricating film. The socket rings 4 and 8 are mounted on roller bearings in their respective boxes 3 and 7, so that the gear is practically frictionless.

General view of the hydraulic variable speed gear. The central valve plate is shown in the insert.



Mechanical details of the hydraulic speed gear.

The speed gear taken apart. The control shaft shown at the left.

The method of controlling the inclination of the box 3 by means of the control shaft 12 is illustrated in the photograph, which shows the parts of the gear removed from the casing and separated. The box 3 is formed with an arm which carries a sliding nut engaging a threaded extension of the control shaft 12. Turning the shaft 12 results in moving this arm up or down, and thereby tilting the box 3, which has pivotal connection with the casing.

The chief advantage of this type of transmission is its great flexibility. The *B* shaft may be started under a dead load of any magnitude within the strength limits of the machine, without any fear of overloading the motor or source of power, the speed may then be increased gradually and positively to its maximum without steps or abrupt gradations. Its remarkable flexibility must necessarily give wide differences of efficiency. Under the best conditions efficiencies ranging from 85 per cent to 91 per cent are common; under average working conditions the efficiencies vary between 80 and 85 per cent; under small loads and low speeds of the *B* shaft the efficiencies range from 80 per cent down to 50 per cent or less. Of course at a zero speed the horse-power efficiency must be zero per cent, while the torque efficiency remains at 95 per cent, and so the horse-power efficiencies have a wide range from zero per cent to 91 per cent, while the torque efficiencies throughout the whole range remain between 90 per cent and 96 per cent.

Aside from turret and gun control on battleships these hydraulic gears have been applied to automobiles, tram cars, drawbridges, cranes, hoists, machine tools, and the propelling of vessels. Indeed, the field of application seems as wide as the transmission of power at variable speeds.

Preserving Cut Flowers

MODERN research in France has developed the art of preserving cut flowers to a point undreamed of a few years ago. The old way was to cut off the end of the flower stem or sear it or add salt water. Fourton and Ducomet applied the principles of osmotic pressure to the subject. They reasoned that when flowers containing salts in their juices were placed in pure water, the unequal pressure thereby developed ruptured the cell walls and made the plant wilt. Consequently they tried a great number of solutions for preserving the cut flowers and found that when the osmotic pressure of the solution outside equaled that of the juices in the flower, the best results were obtained.

Sugar solutions of varying strength proved the most effective except in the case of lilies, lilacs and sweet peas. Carnations lasted longest in a fifteen per cent sugar solution, while roses were most permanent in a sugar solution of half that strength. Chrysanthemums and tulips are not benefited, but effort is being made to discover a suitable preservative for them also. Although lilacs are not benefited by a sugar solution only, yet if they are kept in a twelve per cent sugar solution which also contains one hundredth of one per cent manganese sulphate, they last much longer than usual and improve in that. One of the United States experiment stations has begun experiments in this line and [illegible]

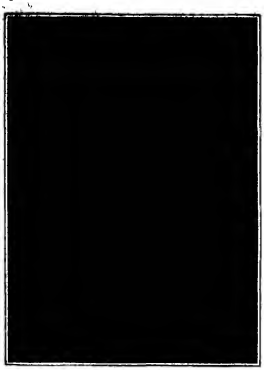


Fig. 1.—A three-lamp projecting apparatus.

Fig. 2.—A home lantern for projecting dissolving views without shutters.

Dussaud's "Cold Light"

Its Remarkable Applications

By Jacques Boyer

Fig. 3.—A searchlight to be used by firemen.

THE accompanying photographs are probably the first illustrations of the apparatus which has been invented by Prof. C. F Dussaud, to produce what he calls "cold light" In a sense, the term "cold light" is not absolutely correct. Heat is necessary to produce light in Dussaud's apparatus, as it is in every other lamp, but the term is justified in so far as Dussaud's lamps radiate a negligible quantity of heat.

How this paradoxical result is obtained will be clear if we refer to the accompanying diagrams (Figs. 6a and 6b) The Dussaud system consists essentially of a series of tungsten-filament lamps *e*, mounted near the periphery of a wheel or disk composed of any suitable insulating substance and carried on an electrically insulated shaft a^1 turning in a support *b* A metallic pulley *c* is mounted on this electrically insulated shaft a^1, and the pulley is connected by a belt c^1 with a crank or a small electric motor *d*. Each of the bulbs is fitted into a socket *f* secured on the disk and communicating with one of its poles, the other terminal being connected with the lamp-base f^1 The end of each lamp-base f^1 engages a metallic ring *g*, mounted on the rear of the disk *a*, and connected by bars *h* with a plate h^1, adjacent to the metallic pulley *c*, against which a commutator brush *i* contacts, the brush being connected with one of the poles of the source of electricity The other pole communicates with a commutator brush *j*, the contact point of which lies in the circumference of the circle described by the sockets *f*

As the disk *a* is rotated by the motor *d*, all the lamps *e* are successively and intermittently lighted when they touch the commutator *j*, and are successively extinguished as soon as they leave it. As soon as one lamp moves away and is extinguished, another immediately takes its place and is illuminated, the retinal persistence of the intermittent flashes giving the effect of a steady light. Each lamp is supplied with current for such a very brief interval that the slight amount of heat to which it is subjected is very quickly dissipated. The cooling interval is about double that of the light interval

Dussaud has found that with this apparatus it is possible to "overvolt" his lamps, that is, he can impress upon them a voltage from two to four times above their normal Hence the efficiency of the lamps is greatly increased and a very much more intense light is obtained from a given filament The effect of overvolting is remarkable In a paper read before the Academy of Sciences by Branly, it is stated that with 50 to 160 watts applied to 16 lamps of 25 to 80 candles, Dussaud has respectively obtained 250 to 800 candles of cold light for several hours.

As our illustrations show Dussaud employs an optical system with his lamps, in other words, either lenses or mirrors. The result is that while the heat effect of the electric current is dissipated over a great area, the luminous rays are concentrated in a very small point or space.

The tungsten lamps employed are of Dussaud's own design Some of them are only 0.8 to 1.6 inches in radius. Groups of three are used in some models. They are successively flashed in the focus of a condensing lens, without breaking down the filament or blackening the bulb Indeed, it is said that the results produced are identical with those obtained with an electric arc ten times more intense

Dussaud's new light is particularly adaptable for use in situations where great luminosity must be obtained with a feeble current These conditions, for example, are those which manufacturers of moving picture projectors have long tried to realize Dussaud has shown that it is possible to project moving pictures on a sheet five yards square with an electro-generating apparatus of 150 watts, in

(Concluded on page 501)

Fig. 4.—A photograph of an interior taken by Dussaud's cold light.

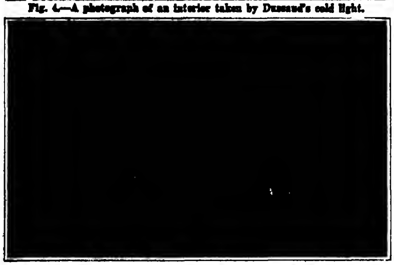
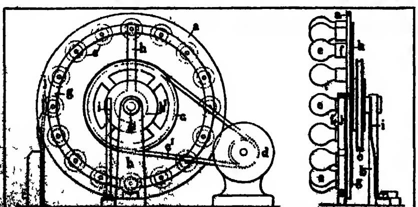


Fig. 5.—A "cold light" moving picture projector, in which the film may be stopped without danger of ignition.



Figs. 6a and 6b.—Front and side elevations of Dussaud's 16-lamp machine.

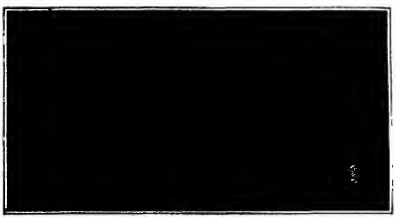


Fig. 7.—Dussaud's 16-lamp "cold light" apparatus.

Plans for the Disposal of New York's Sewage

A Treatment Plant on an Artificial Island Three Miles Offshore

LOOKING out of the window of his office in the Whitehall Building, Dr George A Soper, president of the Metropolitan Sewerage Commission of New York, recently saw a man filling a barrel with water from the North River at the Battery Sending one of his men out to learn what use was to be made of this water, he received the startling information that it was to be sent to a town in Vermont to furnish sea baths for a sick baby whose parents could not afford to take it to the seashore as directed by the family physician. The man was astonished to learn that his barrel was filled not with sea water but with *sewage!* With many other people in this city, he shared the notion that all salt water is proof against disease and that even though the waters about New York may not appear very clean, they are perfectly harmless. Yet it has been demonstrated that typhoid germs live in salt water just as long as in fresh They have actually been found to live in oysters for forty three days, or as long as the shell fish could be kept alive

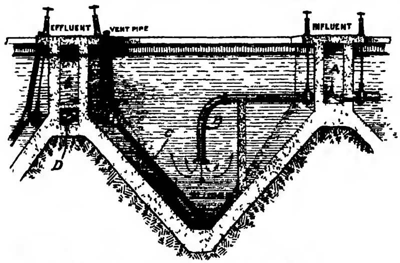
Popular ignorance on questions of sewage and on the dangerous condition of New York Harbor is appalling Free baths are used which in many places have been placed almost at the very mouths of large sewers. Many a bather has become ill through diseases caught from the filthy waters. In order to show how sewage water finds its way into these bathing places strong dyes were recently placed in a sewer, and before long the waters of an adjacent municipal bath were so reddened as greatly to alarm bathers. The very first thing a bather does is to duck his head under and take in a mouthful of the water, in that way exposing himself to all imaginable forms of disease germs that infest these bathing places. Exactly how much sickness results is difficult to determine, for the reason that those who patronize the baths live in disease-infested environments but the municipal authorities are now awake to the dangers and are considering plans for floating baths in which Croton water or filtered sea water will be used

There is no doubt that our ignorance of sewage conditions is due mainly to the fact that the subject is not a pleasant one to investigate. But conditions have grown so bad in this vicinity that the matter has been forced upon us. Several years ago the Legislature of New York State directed the city to appoint a commission to investigate the problem confronting New York city and offer suggestions as to the disposal of the city's sewage The members of this commission, who were selected by Mayor McClellan and reappointed by Mayor Gaynor, are particularly suited to the work

George A. Soper the president, is a civil engineer who has also had wide experience in the management of epidemics He is one of the few American members of the British Royal Sanitary Institute He recently made an exhaustive study of subway ventilation and suggested many improvements that have been adopted and are now in service Three other members of the commission are also engineers James H Fuertes, a man of international reputation on questions of sewage disposal and water purification, Charles Sooysmith father of caisson building foundation, H de B. Parsons Professor Emeritus of Practical Engineering at the Rensselaer Polytechnical School, Troy, N Y The fifth member Linsly R. Williams, is a physician of wide reputation who is considered for State Commissioner of Health.

The work of this representative body, while not yet complete has been disclosed in a number of preliminary reports which indicate that the problem has received a very careful and thorough study Their findings are entirely impartial and their suggestions are perfectly feasible from the engineering and sanitary standpoint. Their conclusions have been reached only after examining into the methods of handling the sewerage problem in other cities in America and in Europe, and consulting with eminent foreign experts in the fields of Chemistry, Engineering, Biology and Hygiene.

In their investigation of New York city conditions they found that the Harlem and the lower East River presented the worst conditions. Into the East River, in 1910, two hundred and sixty four million gallons of sewage emptied every twenty-four hours. The sew-



Section through one of the proposed settling tanks.

Map showing New York's proposed sewage disposal system. Sewage from the shaded territory will be carried to the artificial island.

age came from territories in Manhattan, Queens, and Brooklyn, populated by 2,058,000 individuals. In the narrow Harlem River 90,000,000 gallons of sewage were received daily The North River received only 132,000,000 gallons of sewage daily from a population of 726,000 in Manhattan and 283,000 in New Jersey, the latter contributing 34,000,000. It is possible that the very fact of our calling these bodies of water "rivers," has led to the impression that they can handle any amount of sewage easily The Harlem River is not a river, but merely a strait connecting the North and the East rivers. There is no actual flow in this strait except that produced by the tide. The East River is in no sense a river, but merely an arm of the sea, while even in the North River there is little flow except that due to the tides. In order to study the direction and character of currents in New York Harbor, floats have been placed in various localities and records of their movements have been kept. One of these floats placed in the East River traveled in 78.5 hours 107.79 miles, at the end of which time it was picked up only a mile from the starting point. It serves to illustrate how sewage is carried back and forth by the river with little prospect of being carried out to sea Every year the Department of Docks and Ferries dredges out about 400,000 cubic yards of deposits from the slips and docks of the lower East River, while in addition to this, large quantities are also dredged by private enterprise. One of the worst points in this section is Newtown Creek, which probably holds the world's record for filth. In Wallabout Bay a nine-foot sewer empties at the bulkhead line, in water that is so sheltered from the currents of the East River, that there can be no satisfactory dispersion of sewage. Even worse conditions are found outside of the lower East River section in Gowanus Canal, whose waters are black with filth, for the reason that nine sewers empty into the blind channel. In the hope of improving the canal a tunnel has been built, connecting it with the upper bay, through which the sewage water is pumped from time to time, but this has had little effect upon the canal and has not bettered matters, for the reason that the waters of the upper bay are already charged with far more sewage than they can take care of.

In considering the sewage problem of New York, it was found necessary to divide the city into sections, as indicated in the accompanying map. Tentatively, it is proposed that the sewage pouring out of Manhattan into the Hudson River be treated for the removal of solids and grease and then be allowed to discharge into the stream. The solids would have to be collected at some central point and burned, unless some use for the material was found. Similarly, the sewage from Richmond and from that part of Brooklyn facing the upper bay as well as from certain portions of the Bronx and Queens would be treated for the removal of solids. The most serious points, however, were the Harlem River and the lower East River To take care of the sewage now emptying into the Harlem River, it is proposed that a sewage disposal plant be built on Ward's Island, which would receive all the sewage coming from the Bronx and the upper eastern side of Manhattan The sewage here could be treated for the removal of the solids, the liquid emptied into the upper East River, and the sludge carried off to sea in tank steamers. Another plant could be placed at Tallman's Island.

For the lower East River a plan has been proposed which at a first view may seem rather daring. It calls for the construction of an interceptor taking in the sewage from the lower east side of Manhattan, dipping under the East River, joining an interceptor on the Brooklyn shore and then passing on out under the lower bay to an artificial island built three miles offshore. This line would take most of the sewage now emptying into the East River, and just before reaching the lower bay it would receive the sewage from the vicinity of Jamaica Bay The tunnel would pass out to sea at a depth of about sixty feet.

The outlet island would be built on a shoal, which, judging from the surveys of the past sixty or seventy years, is practically permanent. There are no insuperable difficulties in the way of building the island, there are no engineering difficulties in the way of building a tunnel from the main line to the island, or of constructing the siphon under the East River, and there are no sanitary obstacles that present themselves in the disposal of the sewage on the outlet island. Everything about the proposed plan is based upon prac-

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Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Electrical Auctioneer

To the Editor of the SCIENTIFIC AMERICAN

In consequence of an article in your issue of April 26th, page 371, on the "Electrical Auctioneer in Holland," I beg to inform you, that this system has been in application for several years in the auctions of vegetables at Delft and at Loosduiner near The Hague, and with excellent results It is perhaps known to you that these environs supply Berlin with vegetables

The Hague. A. LUKKIEN

The Dangerous Position of Aeroplane Motors

To the Editor of the SCIENTIFIC AMERICAN

The sad and unnecessary death of Lieut Park in an army biplane near Los Angeles on May 9th, brings those interested in aviation face to face once more with a fatal error in design which places the motor behind or beside the pilot's seat in an aeroplane. This error has caused a large share of the prejudice now existing among people, but they are not generally aware of the chief, the underlying cause of the deaths of several of the world's best aviators.

There are many cases so similar to that of Lieut Park that a statement of the manner of his death will suffice to show that the placing of an engine in such a palpably dangerous position is little short of criminal This is the opinion expressed by every aviator and mechanic with whom the writer has discussed the subject. It is a point which should be emphasized by the press and everyone interested in the future of aviation and the safety in design of flying machines of all types.

The writer has seen motors torn from beds to which they were often insecurely fastened and literally buried in the ground by their force of impact The shock necessary to dislodge a two or three hundred pound mass of metal would, in many cases, be insufficient to bruise more than slightly the pilot of a machine were he not crushed by the motor This has been demonstrated in many accidents to machines built with the heavy parts placed in front of the driver

Hubert Latham was not even badly shaken up in a fall of a hundred and fifty feet which demolished a barbed wire fence, the landing chassis, propeller and one wing of his 1,400-pound Antoinette monoplane at the Los Angeles aviation meet in 1910, the day before Hoxsey was killed at the same meet. On the other hand, a well-known aviator told the writer of a fall in which he barely escaped death when his motor, placed a little to one side and at his rear, was dislodged and shot past him, making a hole two feet deep in a plowed field

An eye witness of the accident to Lieut Park says that the "tree" which wrecked his machine was only a bush, a fall from the top of which would probably not have injured anyone. The officer's head was horribly mangled by the heavy motor

The flying machines of to-day are certainly an improvement over the earliest makes, but beyond a doubt they are faulty in many points. Many of these faults are difficult to remedy, but the problem of locating the motor is certainly very easy of solution. More attention should be given by all designers to placing the motor in aeroplanes in such a position as to give the pilot this one insurance of safety at least

Will army engineers, in justice to the men who risk their lives for their country, alter the machines now in use and make the placing of the motor in front of the pilot one of the requirements for acceptance by the Government? This will cost little, surely not as much as the loss of men of Lieut. Park's caliber

Pasadena, Cal. WOODWARD F BARNWELL

Battleship Protection for the Pacific Coast

To the Editor of the SCIENTIFIC AMERICAN

In your issue of October 12th, 1912, in an article on the last naval review in the Hudson River, the following appears.

"The great mobilization of the Atlantic fleet at New York, for inspection by the President of the United States, is the largest and most important gathering in one place of the ships of the United States navy that has ever occurred Last year ninety ships were mobilized at New York, whose total tonnage reached 576,634. To-day there are gathered in the Hudson River 123 ships of all classes, whose aggregate displacement is 720,496 tons That the people of New York and visitors from the various states will thus have under their eyes, at one and the same time, practically the whole fighting force of the United States navy, is shown by the fact that the latest official summary of the displacement of all the ships of the United States navy gives the total as 758,499 tons. So that the fleet at New York is only about 38,000 tons short of including the whole of the effective navy"

It may be rather late to quote the above from your October 12th issue, but since Secretary of State Bryan has made his hurried trip to California, it seems to us that the above facts are a great deal truer to-day than then When you say, "the fleet at New York is only about 38,000 tons short of including the whole of the effective navy," we wonder where that 38,000 tons is Does it include that one battleship that might have swelled the number to thirty-two at the review? It certainly does not include the six armored cruisers that compose the Pacific fleet, or the famous old "Oregon" (our one lonesome battleship on the entire Pacific Ocean), or the "Saratoga" (formerly the "New York"), the "Monterey" or "Monadnock" of the Asiatic station And let us add that the last two named vessels belong to the class that are used in gunnery experiments on the Atlantic side

The thirty-one battleships that participated in the great review at New York carried a total of 122 12-inch and 13-inch guns The total number of 13-inch guns on the Pacific is eight, for since her rebuilding the "Oregon" carries eight 13-inch instead of the original four 13-inch and eight 8-inch The monitor Monterey" mounts two 12-inch and two 10-inch guns, and the "Monadnock" four 10-inch guns. This is a total of eight 13-inch, two 12-inch, and six 10-inch guns afloat on the Pacific to-day, and each one of these ships is in reserve, and then, too, the guns are of old patterns and not to compare with those of the crack ships of the Atlantic fleet.

The effective fighting force on the Pacific consists of the six armored cruisers of the "California" class, of 13,680 tons displacement, which form the Pacific fleet, and the old armored cruiser "Saratoga," of 8 150 tons, of the Asiatic fleet The remaining vessels of these two fleets are cruisers and gunboats that are fit only for police duty The "California" class mounts four 8-inch and fourteen 6-inch guns, the "Saratoga" four 8-inch and ten 5-inch, so it is easily seen that the heaviest gun in active service on the Pacific to-day is of 8-inch caliber, and only twenty-eight of them, compared to the total of 104 12-inch guns that are carried by the twenty ships of the Atlantic fleet.

As an argument for having a sufficient naval force on the Pacific, a comparison of the territory supposed to be guarded by the navy is interesting On the Atlantic side draw a line from Maine to Porto Rico and the Panama Canal, on the Pacific this line would stretch from Panama on the south to Tutuila, Samoa, thence to Guam and the Philippine Islands, and back again to the vicinity of the Hawaiian Islands, from where it would go straight north to Alaska This experiment will give the uninformed an idea, of the vast amount of territory over which the two small fleets on the Pacific must hover as compared to that guarded by the Atlantic fleet

Mt Vernon, Wash R E BOWSON

Recent Assaults Upon the Patent System: What They Mean to Manufacturers

PENDING in Congress to-day is a bill which cuts down from seventeen years to three years the most essential protection now afforded to manufacturing patent owners, and lays upon manufacturers of patented articles prohibitions and penalties in respect to the merchandizing of patented articles which, if imposed upon the merchandizing of articles generally, unpatented as well as patented, would never for a moment be tolerated in any commercial country in the world.

This bill cannot be disregarded as pure freak legislation. Reported favorably by the House Committee on Patents in the last Congress, and reintroduced in the present Congress by Chairman Oldfield of that committee, its possibilities of evil to small manufacturers, to independent inventors, and to their industrial research, experimentation and development, that alone keep America in the front rank of nations, constitute the most menacing cloud upon the business horizon.

The Oldfield bill proposes that if any applicant shall establish in a Federal District Court that a patent owner, who has purchased a patented invention from the original inventor, is withholding it "with the result of preventing any other person from using the patented process" more than three years after the patent is issued, the Court shall order the patent owner to grant to the applicant a license to use the invention upon such terms of royalty as the Court "deems just."

The burden of litigation which this proposal involves would give large corporations the greatest advantage over ordinary patent owners.

The excuse offered for this universal proscription of patents is that patents are sometimes "suppressed"

Thomas A. Edison has time and again declared that he never knew of a valuable invention being suppressed. For twenty-seven days the House Committee on Patents took testimony upon the Oldfield bill, and not a single case of suppression" was cited. Almost unanimously the witnesses emphatically opposed the bill with conclusive proofs that its proposals were unwise.

If the small independent manufacturer could be compelled to license his big competitors to manufacture all the second and third best inventions that he has acquired tested and laid aside in favor of his best invention, his big competitors, with their superior advantages of capital and selling organization, could soon crowd the smaller manufacturer, even with his superior invention, completely off the market.

Instead of preventing suppression of inventions, the Oldfield bill would really facilitate it.

The Oldfield bill proposes that whenever any patent has been used in connection with any combination in restraint of trade, the patent may be condemned and forfeited, and further that "such restraint shall be conclusively deemed to have been or to be unreasonable" and in violation of the Sherman law if the vendor of any patented article does any of a number of acts None of these acts are forbidden to manufacturers or dealers in *unpatented articles* Only those who have spent their time and money advancing progress and the arts by developing and introducing new and useful inventions are subjected to this wholesale outlawry But every manufacturer and dealer in *patented articles* becomes a criminal if he tries to secure a year's business as a condition of selling to a dealer If he tries to hold the dealer to his agreement to buy his patented goods exclusively or to a certain extent If he tries to hold the dealer to his agreement to maintain a standard price on the patented goods If he licenses the use of a delicate patented machine on condition that it be used only with specially prepared supplies or in conformity with specially adapted machinery necessary to insure the perfect operation of the patented machine If he limits the licensee's use of the patented machine to a particular line of business so that he may license to others the exclusive use of his patented machine in other lines of business, if he agrees with a retailer in a town to sell his patented goods to no one else in the same town or to sell to other retailers only on less favorable terms, in consideration of which the retailer shall push the sale of the goods, or if he sells his patented goods in any particular territory at a less price than he sells elsewhere

The penalty for doing any of these things is the forfeiture of the patent a fine of five thousand dollars and a year's imprisonment, and the payment of threefold damages and the costs of suit and attorneys' fees to anyone who comes in within three years thereafter and proves any damage But manufacturers and dealers in every other form of property are left absolutely free to do any or all of these things.

In the closing days of the last Congress, members of the House Patent Committee, representing both parties, united in a minority report against the Oldfield bill They showed that every evil for which the bill had been urged could be cured under existing laws, and that under the Sherman act interpreted by the Supreme Court in many recent decisions, the patent laws afford no protection to any form of restraint of trade Thirty five years ago an assault upon the patent system embodying proposals almost identical with those of the Oldfield bill, was defeated in the United States Senate If American manufacturers and inventors, whose existence is now threatened by the Oldfield bill, join hands with the opponents of the Oldfield bill in Congress, the patent system can again be saved.—*Abstract of an address by Gilbert H Montague of the New York Bar, delivered before the National Association of Manufacturers' annual convention, Detroit, Mich, May 21st, 1913*

The Current Supplement

IN this week's issue of our SUPPLEMENT C R. Darling describes some experiments with liquid globules and columns. Our readers will recall the very elegant experiments with very large spherical drops presented by the same author several weeks ago.—Prof W H Bragg, in an article entitled "Radiations—Old and New, gives an excellent survey of the remarkable achievements in the recent investigations of corpuscular and other radiations.—Sidney Low discusses the birth rate in its relation to military armaments.—The cork industry is described and illustrated—In an article Evolution from the Standpoint of Physics, A J Lotka gives an exposition of the physical significance of the principle of the survival of the fittest, or, as it is stated in physical terms, the principle of the persistence of stable forms.—A very valuable article comes from the pen of Prof. E. Baur, on the subject of the production of electric power direct from coal The problem appears to be well on the way toward solution—Prof J P Norton writes on that all important subject 'The Changing Cost of Living," and gives us an account of comparative measurements made in this country and abroad.

A New Parseval Airship

By Walter Isendahl

THE Berlin Airship Company has constructed, at its Bitterfeld "shipyard," a new Parseval airship for a foreign government. The new vessel is the seventeenth Parseval airship, and consequently bears the provisional designation P L. 17 It was built in the remarkably short period of two months.

The new airship, like its predecessors, is of the flexible type, but it exhibits many radical innovations which greatly alter even its external appearance The envelope is slenderer than usual, and approximates to the form of a shark. It is girdled by numerous hoops, which distribute the weight of the car uniformly and give the envelope stiffness. The latter does not show the characteristic yellow color of Parseval airships as its fabric is impregnated with aluminium, which gives the vessel a beautiful silvery appearance. There are two propellers, placed to the right and left of the car, and above it Each propeller has four blades of elastic steel only 1/25 inch thick. The propellers are driven by two six-cylinder Maybach motors, which have an aggregate power of 400 to 420 horsepower The speed of the new vessel, 41½ miles per hour greatly surpasses that of any other Parseval airship and has heretofore been regarded as unattainable by non rigid vessels of this size In other respects also, greatly increased efficiency has been obtained. The available ascensional force is about three tons, and fuel sufficient for a continuous flight of more than twenty hours can be carried The official trial trip via Koethen, Leipzig, Dessau, and Halle occupied six hours. The foreign officers present were exceedingly well satisfied with this performance, and accepted the vessel for their government

The Good Roads Movement

FOLLOWING the recent publication of the *Good Roads Year Book*, which presents the road situation in the United States to date, the American Highway Association has begun the issuance of a series of instructive papers presenting the most important phases of road improvement from the standpoint of both the layman and the engineer

Among the first to be issued is a reprint of the address of W W Finley, president of the Southern Railway, at the recent American Road Congress on "Good Roads and the Cost of Living" Mr Finley holds that the cost of living is largely an economic question and that efforts should be turned toward increasing the area of farm land under cultivation and increasing the yield of farm products per acre He points to the well known fact that prospective farm settlers are largely governed by railroad and public road facilities, and that when these are not adequate, farm operations are discouraged.

"Increasing farm products by getting more people on to the land and by bringing a large area under more intense cultivation is largely a matter of transportation" said Mr Finley

Concerning public roads as feeders to railways, Mr Finley says "May it not be a fact that the transportation needs of many localities that seem to be waiting on railway construction would be met more satisfactorily and more comprehensively by a system of good roads connecting them with existing railways? The railway should be located with reference to the main traffic channels. It can no more take the place of the wagon road for the collection and distribution of traffic in a rural community than the wagon road can replace it as a main highway of commerce. Considered as parts of a general transportation system the railway and the wagon road supplement each other, and I believe that this relation should be recognized in the formulation of plans for road improvement."

Among other papers to be issued will be those which deal with the construction and maintenance of all types of road, the selection and testing of road materials, adequate accounting systems for the expenditure and safeguarding of road funds, the use of convict labor in road improvement instruction in highway engineering in schools and colleges, the beautification of roadsides.

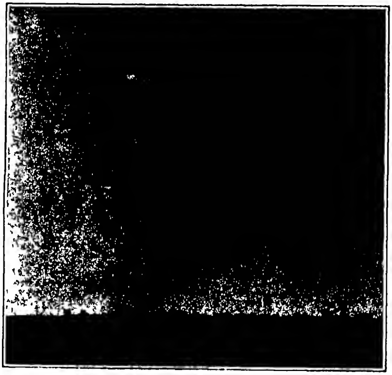
The American Highway Association is composed of upward of 2,000 of the leading men and women of the nation and is conducting a great campaign of good roads education and reform throughout the United States. Its president is Logan Waller Page, director United States Office of Public Roads, and its secretary is J E. Pennypacker, former Chief of Road Management in the Department of Agriculture, and afterward Chief Statistician for the Joint Congressional Committee on Federal Aid in the Construction of Post Roads. The headquarters of the association are in the Colorado Building at Washington.

Stimulating Plants by Radium

VARIOUS methods of stimulating plants in a state of rest to resume growth have been successfully adopted, such as the ether treatment, the warm bath process, injections, etc. The brilliant plant physiologist, Prof. Hans Molisch, some of whose work has already been described in this journal, now announces his discovery that radium has a similar effect, causing twigs of various kinds to begin "budding" much earlier than is normally the case.

We find an abstract of his experiments in the *Naturwissenschaftliche Rundschau*. Herr Molisch made use both of the radium emanation and of radium salts inclosed in glass tubes or spread on metal plates. The tubes held radiumbariumchloride. The metal plate gave off strong α-rays, which were almost entirely absent from the glass tube because of the absorption. In the experiments with radium emanation, the rays from a flask filled with an aqueous solution of radium chloride passed into a cylindrical glass vessel which was the culture chamber The twigs placed in this were exposed to a radium emanation ranging from 1.84 to 3.45 millicurie. Only the twigs of *Syringa vulgaris* were used in the *former case*, but various plants were exposed to the emanation. The terminal buds of the syringa, which were subjected to the influence of the radium preparations for one or two days in December or at the end of November, and then placed in ordinary light in a greenhouse, budded in a short time, while those not thus treated budded much later or not at all. When the radiation was not continued long enough no effect was visible. When too long continued the effect was inhibiting, injurious, or even fatal. The time chosen for the experiment is also important. In September and October, when the state of rest is firmly *established*, the radiation had *no effect* In January or later, when the rest-period is already past, there is either no difference observed or else the twigs subjected to the rays seem slightly retarded. This is similar to the effect of the ether and warm bath treatments. The emanation had a more marked effect than the radium salts. This is because it influenced the plants more uniformly and from all sides. Other plants favorably influenced by the emanation were *Liriodendron tulipifera*, *Aesculus Hippocastanum*, *Staphylea pinnata*, and in some degree *Acer platanoides*

The process is too costly for commercial use, but is of scientific importance in connection with recent investigations of the effect of narcotics on the chemical composition of resting parts of plants. On growing parts radium preparations of like strength have an entirely different effect, as Molisch hopes later to demonstrate.



A new Parseval airship.

A Number of Shock Absorber Patents.—Patents Nos. 1,058,410 to 1,058,414 have been issued to Walter H. Cook, of New Orleans, for shock absorbers which include cushioning elements in the form of a heavy rubber tube operating pneumatically between certain parts where it is desired to absorb the shock.

The Brazilian Battleship "Rio de Janeiro"

By [illegible]

THE Brazilian battleship, "Rio de Janeiro," which was launched at Messrs. Armstrong, Whitworth & Company's Elswick yard on January 22nd, is at present the biggest battleship afloat, displacing as she does nearly 28,000 tons, with dimensions of 660 feet (w. l.) by 98 feet by 28 feet.

As originally designed she was to have displaced 32,000 tons and carried an armament of twelve 14-inch guns, but consequent upon a change of presidency the plans were altered, "considerations of every kind pointing to the inconvenience of acquiring such a vessel." Drastic alterations were, therefore, made in the specifications and the present design substituted.

The main armament of fourteen 12-inch guns is carried in seven twin turrets of 9-inch armor, all disposed along the center-line, four being on the forecastle deck and three on the upper deck. When the first details of the ship became public it was asserted that the fourteen guns would be disposed in two triple and four twin turrets, and it was quite possible that some such idea was at one time considered.

The triple turret originated in Germany, but has never been adopted there, and in Great Britain it has always been regarded with disfavor, on that account it is not likely that Messrs. Armstrong would recommend its being installed in the "Rio" had the Brazilian Naval Commission originally decided to so mount the guns. The present arrangement allows for all the weapons to have bilateral training with a fore and aft fire of four guns. A secondary battery of twenty 6-inch guns are mounted along the upper deck and in the superstructures, and of these six have axial fire, fore and aft.

The upper deck guns have 6-inch protection, while the remainder are behind shields. In addition twelve 3-inch q. f. are distributed over the superstructures and have a good all round concentration of fire. Three 21 inch tubes constitute the torpedo equipment

The "Rio's" protection consists of 9-inch water-line, lower and main deck belts. Forward, the main deck belt is 4 inches and the other two 6 inches in thickness, while aft the water-line and lower decks have 4 inches to within some 30 feet of the stern. Forward there is a 12-inch conning tower, and aft a small armored observation tower, at the base of the mainmast.

An interesting feature of the ship is the provision of three-armored decks of 1 inch, 1½ inch and 2-inch from above downward.

With a designed horse-power of 45,000 generated by Parsons turbines, the speed is expected to exceed 22 knots. The coal supply is 1,500 to 3,000 tons, plus oil fuel—an exceptional amount for South American ships.

The "Rio" was laid down in December, 1911, and is to be completed early next year In appearance she suggests a huge "Neptune," and will be quite the most formidable-looking ship afloat with her seven big turrets, lofty superstructures and boat deck, huge oblong funnels, tripod masts and arsenal of secondary and tertiary guns.

Cork Paper and Its Uses

ENORMOUS quantities of cork are used annually for making tips on cigarettes. For this purpose the cork is converted into very thin sheets which constitutes what is known as cork paper These sheets are exceedingly thin and come in the market 4¼ inches in width and 6, 7, 8, 9, and 10 inches in length. A package of about two hundred and fifty sheets is scarcely an inch thick. Practically all the cork paper that comes to this country is entered through the New York Custom House and is valued (including 30 per cent duty) at about $800,000 annually It is estimated that approximately one half million dollars worth of cork is converted into cork paper every year, and almost all of this is used for making tips on cigarettes.

The thin cork is pasted on long sheets of paper, which are passed between rollers and automatically covered with paste, while girls with deft fingers lay on the cork and smooth it down as the paper passes along. After this the sheets are passed through the cutting machines, in which they are divided into 8 strips ½-inch wide and wound on reels for use in the automatic cigarette tippers. Each of these machines has a capacity of 10,000 sheets of cork paper a day The total number of sheets used in the world is about 100,000,000, or about a quarter billion square feet. The cigarette tipping machines have a capacity of about [illegible] cigarettes daily. The cost of the finished tips to the cigarette manufacturer is from [illegible]

THE BRAZILIAN BATTLESHIP "RIO DE JANEIRO"

The Heavens in June

Some Data on Schaumasse's Newly-discovered Comet

By Henry Norris Russell, Ph.D.

THE first comet to be discovered in 1913 was found by Schaumasse at Nice on the morning of May 7th. It was then in the eastern sky, in 20 hours 55 minutes R. A. and 10 degrees north declination, between Pegasus and Delphinus. Its motion northeastward, and pretty rapid and it was visible in a small telescope.

Numerous observations have been secured, and a preliminary orbit was very promptly computed by Kiess and Nicholson at the University of California. This shows that the comet was discovered just before its perihelion passage, which took place on the 18th. Its orbit is inclined about 26½ degrees to the plane of the ecliptic, and its motion is retrograde, i. e., it is going around the Sun in the opposite direction from the Earth and the other planets. When nearest the Sun it was 133 million miles from him, and it, therefore never came inside the Earth's orbit.

As it is moving in the opposite direction to the Earth, its apparent motion in the sky will for some time be rapid, and as it is far north of the plane of the ecliptic it is apparently high in the heavens, and so is easy to observe. The ephemeris of its motion which is at present available extends only to May 24th when its computed position is 18 hours 11 minutes plus 30 degrees. A plot of its orbit shows that on May 17th it was about 76 million miles from the Earth and approaching it. It will be nearest us about June 3rd at a distance of some 65 million miles, and then recede with increasing rapidity. From the rough indications regarding its brightness which are available it seems doubtful whether it will become visible to the naked eye, and certain that it will not become at all conspicuous. Exact predictions of its track in the sky during June must await computations based upon a longer interval of observation but it can be stated that, unless the preliminary orbit should turn out to be seriously in error, the comet will move nearly along a line drawn from β Lyræ to η Ursæ Majoris (or perhaps a little south of this), being near the former star about May 27th, and reaching the vicinity of the latter somewhere about June 20th.

Though these indications are necessarily rough, they may be of aid to amateurs who wish to try to "sweep" for the comet.

It will probably not be until all the observations have been laboriously discussed, long after the comet has vanished into the distance that we will know whether it is moving in an ellipse of long period, or paying us a single visit in a practically parabolic orbit, though in the rather improbable event that it should prove to have a short period, this fact may be found earlier.

The Heavens.

Turning to our star map, we may find with its aid many objects of interest, whether the observer has at his disposal a telescope or merely a field-glass. One of the finest regions in the sky is now full in sight in the south—the great star-clouds in Sagittarius and Scorpio. Even to the naked eye this is a magnificent spectacle, and the brightness of the Milky Way, on a clear night, is surprising. With a field glass many brighter patches of small area may be seen in the Milky Way, most of which are star clusters, though a few prove when examined with higher power to be irresolvable nebulæ. One cluster, a little above λ Scorpii is particularly fine, and some of its component stars may be seen with a field-glass. There is no finer region anywhere for telescopic sweeping, whatever the size of one's instrument.

In Scorpio itself we may note the wide double star μ, easily separated by an opera glass, and even by the naked eye when the air is clear enough to give a good view of an object so far south. With a small telescope the stars β and γ are seen to be beautiful and easy pairs. About half way between α and β Scorpii is Messier 80, a globular cluster of stars, so faint and so close to one another that in a small instrument it looks like a small nebula.

Passing westward into Libra, we find the star α to be a beautiful pair, revealed by a field-glass.

γ Virginis and ε Bootis are all fine and well-known telescopic pairs, the first separable with two inches aperture, while the last demands three inches or more.

Passing to the north we find that α Canum Venaticorum is a fine pair of 20 seconds distance, while the Pole-star itself has a companion of the ninth magnitude, about 18 seconds away.

β Cephei (distance 13.5 seconds) and β Cygni (34.3 seconds) are fine easy pairs, and so is 61 Cygni (22.5 seconds) one of our nearest stellar neighbors.

Finally, in Capricornus, low in the southeast, the star α is a fine naked-eye double, and a companion to β is easily seen with a field-glass.

Many of the most conspicuous constellations now visible have been noticed in this survey. Among the others we find Corvus, the tail of Hydra, and part of Centaurus setting in the southwest. Hercules and Corona Borealis almost overhead. Ursa Major in the northwest. Draco high in the north. Cepheus and Cassiopeia low in the northeast. Lyra high in the east, with Aquila lower down and farther south, and the small but conspicuous group of Delphinus, with the ancient but less prominent figure of Sagitta (the Arrow) on the left of this. Finally, high in the south, is the tangled mass of Ophiuchus, struggling to carry the great Serpent which it is his fate to hold.

At 11 o'clock June 7
At 10½ o'clock June 14
At 10 o'clock June 22.

At 9 o'clock July 7
At 8½ o'clock July 14
At 8 o'clock July 22

At 9½ o'clock June 30

NIGHT SKY JUNE AND JULY.

The Planets.

Mercury passes through inferior conjunction (behind the Sun) on the 1st, and is an evening star for the rest of the month. He can be best seen in its closing days, when he sets about 9 P. M., and can easily be seen in the twilight a little south of the region where the Sun has set. He is apparently about as bright as Procyon, and brighter than either Castor or Pollux, near which two stars he passes about the 23rd.

Venus is morning star, in Aries, rising about 2 15 A. M. She is still exceedingly bright, and can easily be seen in full daylight. The only difficulty is to know where to look for her. On the morning of June 1st she is about 4 degrees south of the Moon, and should be easily found with a field glass, and even with the naked eye, if the weather is really clear.

Mars is also a morning star, and is not far from Venus, about 18 degrees farther west and higher in the morning sky. He is a far less conspicuous object, sending us less than one hundredth as much light as Venus, but, even so, he looks like a pretty bright star of about the second magnitude.

Jupiter is in Sagittarius, approaching opposition, but rises late (about 9 P. M.) on account of his great southern declination, and, for the same reason, is not favorably placed for telescopic study.

Saturn, having just passed conjunction with the Sun, is a morning star in Taurus, visible only just before sunrise toward the end of the month.

Uranus is in Capricornus, rising about 10 P. M. on the 15th, but not observable until after midnight.

Neptune is approaching conjunction, and is practically invisible in the evening twilight.

The Moon is new at 8 P. M. on the 4th, in her first quarter at noon on the 11th, full at 1 P. M. on the 18th, and in her last quarter at the same hour on the 26th. She is nearest us on the 10th, and farthest away on the 25th.

As she completes the circuit of her orbit she passes through conjunction with Venus on the 1st, Saturn and Mercury on the 4th, Neptune on the 7th, Jupiter on the 19th, Uranus on the 21st, Mars on the 29th, and Venus again on the 30th, none of the apparent approaches being close.

Mercury and Neptune are in conjunction on the 24th but they are too near the Sun for the latter to be seen.

At 8 A. M. on the 21st the Sun reaches his greatest northern declination—23 degrees 27 minutes 10 seconds—and, in the language of the almanacs, "summer commences."

Princeton University Observatory

The Rarest Trees in the Country

IT is an interesting feature of the flora of the coast of Southern California and the adjacent islands that they contain several plants extremely localized. If the theory of gradual extermination of some plant forms can be accepted, at least one plant can be named here, which will show conclusively that once widely distributed plants will often be reduced to a few individuals and finally become wholly extinct. The Monterey cypress (*Cupressus macrocarpa*) is confined naturally within the county of Monterey, California, and the Torrey pine (*Pinus torreyana*) has its limits restricted still more, being found only in a narrow belt a few miles long on the coast near the south of the Soledad River just north of San Diego, and on the island of Santa Rosa, California, the least widely distributed pine tree in the United States.

While the total number of individuals of these two trees still aggregates hundreds of thousands, there is one plant which inhabits the small Southern California coast islands and is probably the rarest plant in America. It is the western ironwood (*Lyonothamnus floribundus*) and is the only tree species of the saxifrage family of plants. It was not found and described until 1884 by William S. Lyon, Forester of the State of California. On these islands is the last stronghold in America of this very peculiar type, which, as it still exists only in small patches, once occupied a much larger space on the continent than it does at present.

The *Philippine Agricultural Review* of February, 1913, reports two other very rare trees in the Formosan forests. One of these is the shimamomi (*Keteleeria davidiana*), of which there is only one small cluster known to exist on the island. A still more striking case is that of the *Cunninghamia konishi* of Mount Randai. The number of individuals of this tree has been reduced to only five living species.

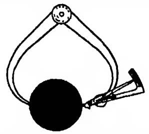
The World's Production of Tea

ALTHOUGH it is difficult to give a close figure for the world's production of tea, this is said to be over 1,127,700 (long) tons. That this is not exaggerated will be seen from the following data for production: India, 128,200 tons, Ceylon, 85,000; Java, 22,000, Japan, 19,400, Formosa, 11,600, China (exportation), 88,600, Natal and Annam, 1,400 tons. To this is to be added at least 36,000 tons of compressed tea in tablets, which is put directly on the market by Chinese firms. There must also be taken into account the tea produced in China and Japan and consumed on the spot, this being estimated to be 5 pounds or less per head, so that for 342,000,000 inhabitants this figures at 774,600 tons. For this reason China and Japan do not figure higher in the export list. It is estimated that the total consumption of tea for the rest of the world is 300,000 tons.

How to Measure Closely With Ordinary Calipers

By H. D. Chapman

THE sketch shows how to get an exact measurement with ordinary calipers. The writer had to machine up a piston for a hydraulic press, and it was to be made the exact size of the old one. No micrometer was to be had large enough to take that size, so in order to be sure that the size was the same, a test



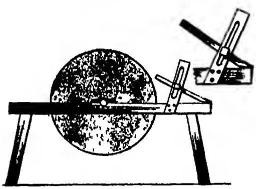
Measuring closely with the calipers.

indicator was attached to one leg of a pair of outside calipers, as shown in the engraving. The calipers were then set to the size of the old piston, and by so doing the pointer on the indicator was set so it would point at any certain figure. The sketch shows the reading at 20. By the use of the calipers fixed in this way it was possible to make an exact duplicate of the old piston. Of course it is understood that calipers rigged up in this way can only be used in transferring sizes or to be used as a test.

A Toolholder for Grindstones

By William Grötzinger

WHEN grinding tools by simply holding them with the hands against the stone, frequent changes of angle will cause much extra labor and result in a poor job. A simple device to hold tools at a constant angle while grinding can easily be made and attached to the grinding stone as follows. Screw on each side of the base of the grinding stone, a wooden arm as pic-



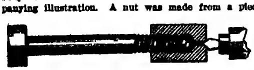
Toolholder for grindstones.

tured in the drawing. These arms should be slotted. A board a little larger than the ordinary plane iron is cut and bored with a ¼ inch hole, running from edge to edge. The board is fastened to the grindstone with a hinge. A bolt is put through the slots in the arms and the hole in the board. The bolt may be tightened up to hold the board at any desired adjustment. The tool to be sharpened is placed on the board and held firmly. This arrangement will allow tools to be set at any cutting angle.

Jig for Turning Up Rough-threaded Bolts

By Joe V. Romig

NEEDING a hundred finished bolts of ⅞ inch diameter and having nothing on hand except rough ones already threaded, the writer was forced to rig up a jig of his own design with which he could turn up the body of the bolt concentric with the thread and the underface of the head at right angles to the finished body. How the work was done is shown in the accompanying illustration. A nut was made from a piece



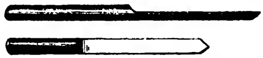
Jig for turning up rough-threaded bolts.

of octagonal steel 1¾ inches thick and 2¼ inches long. This was chucked up and drilled and then tapped to receive the threaded end of a bolt. A 3/16 inch hole was then drilled through the end of the nut. The nut was now taken out of the lathe, rechucked and countersunk at the outer end of the 3/16 inch hole to receive the tail stock center. This completed the jig. The bolt was then screwed into the jig and placed in the lathe, as indicated in the drawing, with the head of the bolt held in the chuck, after which the body and head of the bolt were finished.

Hint for Boring a Straight Hole

By Joseph Vaghi

TO bore a straight hole 3/16 of an inch in diameter, lengthwise through a 12-inch maple round, ¾ of an inch in diameter, is far from a simple task, so the writer was informed by a company manufacturing bits. But as a large number of rounds had to be bored in this manner, the writer was compelled to invent a practical method of doing the work. After a number of schemes had been tried, a successful solution to the problem was reached. A piece of tool steel 3/16 of an inch in diameter was tempered at one end and



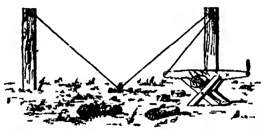
Bit for boring a straight hole

ground off to about one half its thickness, for about two inches from one end, as shown in the drawing. The tool was ground to a chisel point as shown in the drawing, and in order to make it run more easily, a little was filed off back of the cut. Running this through a steel bush at the rate of 1,500 revolutions per minute, the rounds were quickly bored at the rate of seventy per hour. Twenty five hundred rounds were bored without a single miss, whereas in previous attempts with the best single groove bit on the market 80 per cent of the rounds were wasted.

Rig for a Two-handed Saw

By Fremont Leland

THE accompanying drawing shows how a two-man saw may be rigged up to be operated by one person. The writer designed this arrangement for the purpose of sawing a large number of logs single handed, and he found the device very successful. The saw horse was placed beside a post on which a pulley was mount-



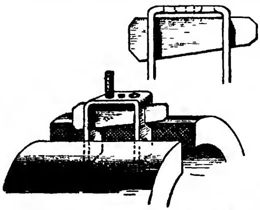
Rig for operating a two-man saw single-handed.

ed. Another pulley was secured on a second post, while between the two a pulley block was fastened to the ground. A rope tied to the free end of the saw passed over the pulleys on the posts and under the pulley block between them. The opposite end of the rope carried a small weight. With this arrangement the sawing of the logs was greatly facilitated.

Device for Holding Screws When Filing Them Shorter

By I. B. Spittell

A VERY simple device for holding screws while filing them down is shown in the accompanying illustration. It consists of a piece of flat iron about an eighth of an inch thick and say ¾ of an inch by 1½ inches long. The piece is bent to a U form. In the bottom



Device for holding short screws in a vise.

of the U-piece holes are drilled to receive screws of different sizes. In the sides of the U-shaped piece, slots are cut to receive a wedge or key of steel. In use the screw is fitted into one of the holes in the U-shaped piece with the head inside and is held firmly in position by driving the key in place. Then the device may readily be secured in a vise while the projecting end of the screw is filed down to the required dimensions.

Two Drilling Kinks

By Fred Horner

HERE are two kinks that have proved very serviceable to the writer and he hopes will prove equally serviceable to the reader.

Using a Rubber Band as a Drill Stop.—A simple form of stop for small drills which are used in the hand-brace or in a drilling machine which has no depth stop is a rubber band. This is slipped over the drill to the required distance, as shown in Fig. 1, and each time that it reaches the face of the work the drilling is stopped. This dodge works well enough for occasional use and the band is more easy to work with than a chalk mark on the drill.

Fig. 1.—Drill stop

Rubber-faced Drilling Pad for the Tail Stock.—Fig. 2 shows a handy form of drilling pad to be fitted to the tail stock of a bench lathe. It is of particular use when drilling small brass plates and other highly polished pieces which are liable to slip on the surface of a metal pad and become scratched. A disk of rubber is connected to the face and this makes a soft bedding for the work, preventing it from skidding or

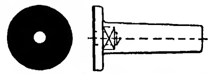


Fig. 2.—A rubber faced drilling pad.

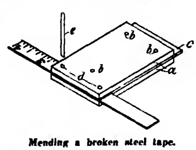
slipping. The rubber disk will be found better in this respect than wood. As an alternative a small block of wood may be faced with rubber and held with the fingers against any part of the drilling pad.

Mending a Broken Steel Tape

By George W. Colles

EVERYBODY who owns a steel tape will sooner or later want it mended. The two pieces should be joined by a butt strap, which is riveted to both pieces by means of small eyelets made for the purpose. Instrument makers furnish special tools costing $5 for punching and setting the eyelets, but few will care to invest $5 to mend a $1 tape. A half hour's work at the bench and a few scraps of sheet metal will make a tool which is as satisfactory for practical purposes as a purchased one.

Take two pieces of strap-iron (*a* in the accompanying sketch) about 2 inches long and ⅛ inch thick, exact dimensions immaterial, ½ to ¾ of an inch wide depending on the length of the desired overlap. Take a thin strip of sheet metal *c* of the same size and having the combined thickness of the tape and strap, or preferably a little less, place all together in the vise,



Mending a broken steel tape.

and with a No. 50 drill bore three holes *b*. Removing the pieces from the vise lay the tape across one end of the strip *c* and scribe along the edge so as to mark a strip having the same width as the tape, which strip is to be cut off. Now replace the three pieces in the original order, cut three short pieces of No. 50 or 49 Stubs' steel rod, and hammer them into the holes *b* for dowels. Two other holes *d* are now drilled along the center line of the cut off strip of the piece *c*. Cut a short piece *e* off the drill rod and file it obliquely on one end for a punch, and the apparatus is complete. All you have to do is to insert the tape and butt-strap as shown, and punch through the holes *d* with a punch *e*. It is necessary to have the rod *e* slightly larger than the drill, so that it will fit snugly in the holes. When the holes are drilled, the eyelets are inserted and turned over with a center punch and hammer. If the strip *c* is sufficiently thin, the tape and strap may be gripped in a vise during the operation, but I have not found this necessary.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Recent Activity in the Explosive Pump Art

AN extremely important patent, of interest to inventors and the scientific world in general, was granted not so long ago to W. H. Smyth of Berkeley, Cal. This patent the application for which had been pending in the Patent Office since 1900, and which is a pioneer in the art, discloses an internal combustion pump for raising water.

The Smyth pump, as seen in the accompanying engravings, is a duplex one, both parts being alike. A combustion chamber 1, the lower end of which is merged into a nozzle 3, extends into a casing 4, which constitutes the suction pipe of the pump. The lower end of this casing is provided with a check valve 5 and a strainer 6, and the upper end is separated from an air chamber 8 by the check valve 7. As seen in Figs. 1 and 2, the discharge of the pump is through a pipe 20, which connects with each air chamber 8. Two pipes 9, having valves 10 to control the flow of air or water, connect the air chamber 8 with the casings 4 just below the valves 7. A water piston, operated by the explosive charge, is located in each chamber 1 and the two casings 4. Air is introduced into the air chambers by means of valves 5a.

To regulate the position of the water piston in the chamber 1, an independent piston 11, free to move in response to head pressure, is provided in the pipe connecting the two casings 4. This piston is actuated by the power piston 19 in the motor cylinder 15, through the link 18, lever 17 and rock shaft 12 and link 16 connected by the yoke 42 to the rod 13, which passes through a stuffing box 14.

As seen in Fig. 3, the motive fluid for operating the motor 15 is introduced and exhausted to and from the cylinder by a four way valve 43 through pipes 45, 44 and 46. This valve is operated by the link 16, carrying the tappet 53, which actuates the levers by riding over the cam surfaces 52. These levers 51 operate in turn, by means of the spring-operated tappets 50, the sliding tappet lever 48, which oscillates the lever 47 of the valve 43.

The apparatus for introducing an explosive mixture is shown in detail in Figs. 4 and 5.

A fuel reservoir 27 (see Fig. 1) is connected to a vaporizer 26, which communicates with the combustion chambers 1 by a pipe controlled by the poppet valve 24 and pipes 21 leading to a four way valve 22. The sparking device, located in the chamber 29, consists of a rocking wiper 30 secured on the shaft 31, which is provided with an operating lever 32, and a flat spring 33 attached to an insulated rod 34. The wires 40 and 41 connect the sparking device with a battery not shown. The tappet arm 28 on the shaft 12 operates both the valves 10 and the wiper 30 by means of the slotted link 36 carrying the pins 37 and 38.

The valve 22, which controls the flow of gases to or from the combustion chambers, is also operated from the rock shaft 12 by the tappet 21, the latter having a cam surface 21a, which operates one arm of a loosely pivoted bell crank tappet lever 22a. This arm of the tappet lever 22a engages with the slotted link 22b, which is loosely connected to the handle 22c on the stem of the valve 22. The other arm of the lever 22a constitutes a tappet which, by engaging the part 21b of the tappet 21, operates the spring-actuated valve stem 25 of the check valve 24, so that the tappet 21 serves the double function of reversing the valve 22 and keeping the valve 24 open. The operation is now evident.

Motion is imparted to the piston 11 by the motor 15, which causes the water piston to move in the chamber 1 and make room for the charge in this chamber. The valve 22 being properly disposed, the action of the piston 11 and the travel of the water piston cause successive inflow of explosive charges and scavenging of the spent gases.

If we assume the explosive charge to be in chamber 1, the water piston will extend nearly to the valve 7, separated from the water and pressure in the air chamber 8 by this valve and by whatever air has been permitted access through the valve 5a. At this point the valve 10 is opened by engagement of the tappet arm 28 with the link 36 and the compressed air, or water under presure from the air chamber, consequently flows beneath the valve 7. Thus the water piston is forced back against the charge, compressing it to the pressure of the air chamber, which is, of course, that of the head. The charge is prevented from escaping by the closing of valve 24.

Ignition now takes place resulting from the engagement of the tappet pin 37 with the end of the slot in the link 36, thus rocking the wiper 30 past the spring 33 by the connection of the link 36 to the wiper arm 32. The slot in the link 36 permits the valve 10 to close the moment the wiper arm 32 passes out of engagement with the spring 33. The expansion of the gases in the chamber 1 causes the water piston to be driven with great energy and speed through nozzle 3.

The spaces vacated in the chamber 1 and casing 4 are filled instantly (practically simultaneously with the expansion) by air through valve 5a. That portion of the air admixed with the spent gases in the casing 4 of the expansion chamber will be cut off and separated from that in the charged chamber 1 by the incoming water through valve 5. The portion of air and gas in the casing 4 is thus trapped beneath valve 7, ready to be driven into the air chamber at the next operation of the water piston. That portion of the spent gases and air in the chamber 1 will pass out as exhaust. The cycle of operation of the Smyth pump is shown in Fig. 6, and described as follows:

1.—Explosive charge being taken in the left hand chamber and discharging the spent gases from the other chamber, the piston 11 being midway of its stroke, traveling to the right.

2.—A fresh charge in the left hand chamber and the right hand chamber completely occupied by the water piston, the spent gases of the previous explosion having been driven out by the water.

3.—Charge in the left

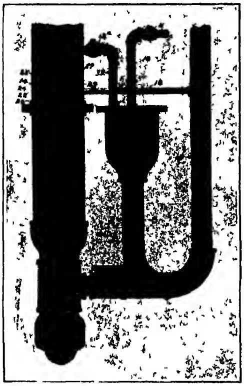


Fig. 8.—The White pump for utilizing full static pressure in compressing the charge.

Fig. 7.—The Chance apparatus for operating internal combustion pumps and compressors.

Fig. 9.—Poore and Harvey device for generating its own gas by electrolysis of water.

Figs. 1 to 5.—Detail of the Smyth internal combustion pump for raising water.
Fig. 6.—The cycle of operation of the pump.

right chamber compressed to less than half of its original bulk by the admission of air pressure between the water piston and the check valve 7

4.—Expansion of charge due to explosion and the travel of the water into the air chamber, preceded by the volume of air from beneath the valve 7 The inrush of the water through the lower check valve 5 induced by the injector, gravity and atmospheric pressure is also shown.

5.—Left hand chamber almost filled with water

6.—Condition similar to 1, but reversed as to direction of the flow of gases and the movement of the water piston.

7.—Charge in the right hand chamber The left hand chamber is completely scavenged of spent gases from previous explosion.

8.—Explosive charge in the right hand chamber ready to be ignited, thus completing the cycle.

It has been the custom in explosive pumps having two combustion chambers to cause the charge to be drawn into one chamber by the continued travel of the liquid piston after the waste gases in the other chamber have dropped to low pressure. In pumps of this character the continued travel of the liquid piston must be sufficient to draw in the new charge, the expulsion of the waste gases is accomplished by the return stroke of the piston and must be completed before the return stroke can compress the charge in the other chamber

The necessity for prolonging both the out stroke and the return stroke of the piston to permit the drawing in of the charge and the expulsion of the waste gases, introduces elements of time by which the capacity and speed of operation of the pump are correspondingly reduced.

A recent patent granted to Messrs. H. M. Chance and T M. Chance of Philadelphia, Pa., shows a method of operating such pumps whereby the rapidity of action is increased by decreasing the time necessary for each out stroke and return stroke.

The apparatus, as seen in Fig. 7, comprises two combustion chambers 1 and 2 provided with inlet valves 3 and 4 for the introduction of the combustible mixture and two exhaust valves 5 and 6 for the discharge of the waste gases.

A spring-pressed valve 7, which controls the communication between the two chambers 1 and 2, is operated by the rod 15 and piston 14 in the cylinder 16. This cylinder communicates with the liquid in the chambers 1 and 2 by the passage 17, and the connection 18 leads to a source of pressure slightly greater than that at which it is desired to exhaust the waste products of combustion. The usual conduit 8 is connected to the air chamber 9, delivery pipe 10 and suction pipe 12 with inlet valve 11 This suction pipe 12 is connected with the source of supply 13.

Let it be assumed that the chamber 1 contains a compressed combustible charge which has just been ignited, the valve 7 being open, the liquid in the conduit 8 is given a high velocity

When the pressure in the chamber 1 falls below the predetermined pressure at which it is desired to open the exhaust, the valve 5 is opened and the valve 7 closed by the piston 14, operated by a pressure slightly greater than that now existing in the chamber 1, the scavenging taking place at atmospheric pressure. The liquid in the chamber 2 now falls by gravity; the inlet valve 4 opens; and a new combustible mixture enters the chamber 2. At the same time the liquid rises in the chamber 1, expelling the waste gases. The valve 4 then closes.

Upon commencing its return stroke the liquid in the conduit 8 opens the valve 7, forcing the liquid into the chamber 1 and closing the valve 5 by the impact of the liquid. The momentum of the liquid in the conduit 8 now causes the liquid to rise in the chamber 2, compressing the charge in that chamber. The cycle is then repeated.

It will thus be seen that a new charge of combustible mixture is introduced while the products of combustion are being discharged, obviating the necessity for prolonging both out stroke and return stroke, and in this manner increasing both the speed and the capacity of the pump.

In explosive pumps it has been the custom to compress the combustible charge in the same chamber in which it is exploded. A recent patent granted to C. E. White of San Francisco, Cal., shows a pump in which the charge is first drawn into a separate chamber and forced thence into the usual combustion chamber by the pressure of the liquid in the delivery pipe. By this means, it is claimed, the full static pressure is utilized in compressing the charge.

The White pump, as seen in Fig. 8, comprises a combustion chamber 2 connected to the supply pipe 4 having the usual inlet valve 5, by the tee 3, which communicates with the delivery pipe 19 through the pipe 6, in which is placed a check valve 7 This delivery pipe 10 is connected to the gas chamber 0 by a pipe 8.

The gas supply pipe 10, having the check valve 11, communicates with the chamber 9, the latter being connected with the chamber 2 by the pipe 12 having a check valve 12a

The exhaust valve 14 comprises a cup 20 provided with a bored extension 21 and a diaphragm 22. This diaphragm 22 is provided with a valve 23 adapted to enter a seat 24, the stem 25 of the valve 23 is provided with a contact 26 to bridge the terminals 27 and 28 to close the circuit of the spark plug 16. A pipe 18 connects the delivery pipe 19 with the cup 20

Let it be assumed that the pump is filled with liquid and an explosive mixture, the contact 26 closes the ignition circuit through the terminals 27 and 28 and the charge is exploded. The liquid is thus forced through the pipe 6, closing the valve 5 and opening the valve 7 The liquid in the chamber 9 and pipe 8 moves downwardly, creating a suction in the chamber 9, whereupon the valve 11 opens and causes a fresh supply of gas to be drawn into the chamber 9. As the liquid moves upwardly in the pipe 19, the pressure on the diaphragm 22 is removed, and the contact 26 is moved downwardly, permitting the escape of the waste gases.

After the explosive force is spent, the liquid in the pipe 19 closes the valve 7 and the liquid piston in the pipe 8 and the chamber 9 forces the explosive mixture into the chamber 2 and compresses the charge against the water, which has by this time risen in the chamber 2.

The cycle is then repeated.

In internal combustion pumps it has been necessary after each explosion to draw in a fresh charge of gaseous mixture from an outside source. This has necessitated gas and air connections which are impracticable when such pumps are used in mines and in many other instances.

To obviate this difficulty, Messrs. Poore and Harvey of London, Eng., have recently patented a device which generates its own gas by the electrolysis of water No pipe connections whatever except those used for suction and delivery of the water are thus needed.

In Fig. 9, the current for decomposing the water is supplied by the dynamo L to the contact L^1, which makes a sliding contact with the chamber G at prearranged periods of time. The upper part B of the body A of the pump forms the explosion chamber The gases formed by the electrolysis of the water are mingled with air introduced in the chamber B through the air valve M, and are exploded by the spark plug K^1

The ignition circuit comprises a primary winding J, having a battery J^1 and switch J^2, and a secondary winding K The float F, carried by the lever H, which is pivoted at H^1, operates to close the firing circuit.

The apparatus is operated by closing the switch J^2 and turning on the decomposing current. The float F is then in its lowermost position, and the contacts L^1 are in contact with the chamber G.

As the water rises, the float F moves the chamber G out of contact with the contact L^1 and, rising still farther, causes the lever H to contact with the contact J^3, thereby closing the primary circuit. The charge is then fired by the plug K^1

The force of the explosion expels the water up the delivery pipe E into the tank O, and also draws a fresh supply of water through the suction pipe C The return movement of the water closes the check valve D and compresses the new charge of explosive mixture. The cycle is then repeated.

The pipe N is used to form a spray for condensing the vapor caused by the explosion.

Legal Notes

Employer and Employee.—The Court of Appeals of the District of Columbia in Eshleman v Shantz and Shantz v Eshleman has held that even if E was in the employ of S, such fact did not deprive E of his right to claim the invention as his own where it appeared that S's communication to E went no further than to evince a desire for a certain result, S suggesting no means by which the result could be accomplished.

Interference Examiners.—The Interference Division of the Patent Office was instituted in 1869, prior to which time interference proceedings were tried and decided in the first instance by the principal examiner in charge of the division in which the interference originated In the 44 years of the existence of the division, there have been 15 examiners of interferences beginning with the first incumbent, J M Thatcher, appointed July 17th, 1869, to the present examiner, H E Stauffer, appointed May 6th, 1910 The longest term of service as examiner of interferences was that of Judge Walter Johnson, now a principal examiner in the Patent Office, whose service extended from November 9th, 1886, to July, 1902, a period of nearly 16 years and more than four times as long as the term of any other official who has occupied the position The rest of interference examiners with the years of appointment is as follows J M Thatcher, 1869, J H Adams, 1870, M S Hopkins, 1872, W B. Philip, 1874, J Newland, 1875, H H. Bates, 1876, Z F Wilbur, 1877, J B Church, 1880, F McArthur, 1883, W Johnson, 1886, C F Fitts, 1902, C C Billings, 1905, J B Macauley, 1907, F Bayard, 1907, H E Stauffer, 1910

Property Rights Overhead—The Supreme Court of the United States has before it on appeal from the Court of Claims the case of Mary R. Peabody *et al* v the United States, in which may be determined a question of interest in aviation, although aviation is not specifically involved It appears that the claimants own a property whose principal value is asserted to result from its use as a seashore resort Within a short distance of the claimant's land, the United States Government erected a coast defense battery known as Battery Bohlen, and the guns of this battery were so placed that the most suitable field of fire in time of peace was over the claimant's land, and it is claimed several guns were fired on three occasions prior to the institution of the litigation, the shot each time passing directly over the claimant's land On behalf of the claimants, it is urged that the space above their land was subjected to use by the Government for the firing of projectiles across it, making it impossible to operate the hotel or use the land as a seashore resort, or indeed for any other purpose.

The decision in this case may or may not determine some question of aerial law of interest in aviation, but it is believed that it will be the first adjudication by the court in a course of litigation that must sooner or later be entered upon to determine the relative rights of birdmen and landowners.

Berlin and Paris have police regulations forbidding the operation of flying machines above the city, but it is not known that such municipal regulation exists in this country, although aviators have instituted regulations controlling the height of flight above cities in the interest of safety both of self and to those on the ground

Notes for Inventors

A Yielding Metallic Railway Tie.—Locksley W Abbott of Delaware, O, in a patent, No 1,054,660, shows a metallic railway tie in which there is a main plate upon which are mounted yielding metallic chairs whose tops are spaced above the bottom plate so that the chairs form bows or yielding loops to receive the rails.

Advertising Theatrical Curtain —Patent No 1,045,637 to John C Taylor of Baltimore, Md, presents a theatrical drop curtain on which is mounted a movable advertising sign actuated by a motor, and the raising and lowering of the curtain operates through suitable means to stop and start the motor so that the advertisement will only be caused to operate when the curtain is lowered.

Cream from Butter Fat Joseph Willmann of Derby, Conn, assignor to Dairy Machinery and Construction Company of the same place, has patented, No 1,058-508, a process in which moisture is removed from butter and the concentrated stable butter so formed is kept until required for use, when it is treated with milk and the resulting mixture is homogenized to form cream

A Novel Flower Vase —It is desirable to provide for holding flowers so they can be secured at different heights, and Paul Mucke of Schonau, Germany has secured patent No 1,045,589 for a flower vase in which there are mounted upon a base plate a number of tubes open at their upper ends and corrugated from the bottom to the top so that the flower stalks may be inserted into the tubes and will be held at any suitable height by the corrugations.

A Fountain Mop for Sinks —Isabel L Lewis of Syracuse, N Y, has obtained a patent, No 1,054,696, for a fountain mop in which a suitable hose delivers the water to the mop head, which head has a suitable handle, and the hose is branched to couple with both the hot and cold water spigots of a sink so water of any desired temperature may be supplied to the mop

A Stand-on-end Shaving Brush —A novel form of shaving brush, having a hollow handle and a reservoir chamber at the end thereof opposite the brush head, is shown in patent to Frederick James Munro, of Halifax, Canada, the reservoir chamber being elongated in the direction of length of the brush and so shaped that when filled with water it will operate automatically to maintain the brush in an upright position

Makes a Magazine Smoking Pipe —Patent No 1,053,089 to Allen A Karnes of Holliday, Mo, presents a pipe in which there is a magazine chamber adjacent to and in position to discharge to the pipe and a number of conveyors from the bottom of the magazine chamber and may be operated to discharge successively charges of tobacco into the pipe bowl

An Armor Plate of Nickel — The claim of patent No 1,052,718 reads "An armor plate for treasuries, safes and the like, made of nickel " The patent is issued to Friedrich Paul Georgi of Niederpfannenstiel, near Aue, Germany The inventor seeks to render futile, attempts to pierce the armor by means of autogenic hole burners, it being asserted that it is more difficult to burn nickel than to burn iron, also that the nickel by combustion is turned into protoxid of nickel, which is much less fusible than nickel

An Old Cow-milking Machine —An early cow-milker that had a suspicious appearance because of the well-known cooperation of a water pump with the national milk supply, was patented in 1879 by a Newark, N J, woman, who connected the barrel of an ordinary suction pump by a pipe with a sack or case of elastic rubber having at its top a contracting band to grip the udder, the sack terminating at its bottom in four tubes to receive the teats and conduct the milk to the connecting pipe and the pump barrel, whence it passed and discharged from the spout of the pump when the pump handle was operated in the usual way

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

SAFETY POCKET.—J W PENNEWILL, Silver City New Mex In this patent the object of the inventor is to provide an improved pocket especially adapted for trousers, and having means whereby to prevent the contents of the pocket from slipping out when the wearer is in a sitting or reclining position

Electrical Devices.

ELECTRIC SIGNAL BOX.—J DERBY 430 54th St Brooklyn N Y Mr Derby's invention relates to electric switch boxes his more particular idea being to produce a switch box having parts actuated electrically and also having connections whereby the box and its various electrically operated parts can be connected up as a portion of a block signal system

PRIMARY BATTERY.—H E R LITTLE 192 Bradhurst Ave Bronx N Y N Y An object here is to provide a structure in which a maximum voltage may be secured at any time without injury to the cell Also to provide a cell in which the active agent is a gas adapted to be continuously supplied during the use of the cell.

Of Interest to Farmers.

YOKE.—J LLORET and J GIMAVEZ Calle Colon No 2, Habana, Cuba The purpose of this invention is to provide a yoke for draft animals such as oxen and the like to enable the animal to more easily carry a load attached to the yoke For this purpose use is made of

YOKE FOR DRAFT HORSES

a main stem adapted to turnably engage the shaft or tongue of a vehicle the main bearing body mounted to swing on the main stem auxiliary bearings on the main bearing body, and head bows mounted to swing on the auxiliary bearings.

INCUBATOR.—O H LEE 1115 Harney St., Omaha Neb. This inventor provides for wholly or partially excluding and admitting heated air to certain and various sections of the incubating chamber and provides manually operable means for adjusting the distributions to equalize or vary at will the temperature throughout the incubating chamber

Of General Interest.

FIRE ESCAPE APPARATUS.—T HOLDISZONI, 320 E. 49th St., Brooklyn, N Y The invention relates to fire escapes of the type which includes a car mounted to slide up and down guides fixed on the surface of the wall of a building so that the inmates in case of fire can utilize the same to make their escape by a quick descent to the ground.

WASHER STRINGER.—D T VANCE, Plum tree, N C This invention relates to devices for stringing washers made of mica or similar material An object is to provide a device which will string the washer without any attention on the part of an operator It provides means for separating the waste and broken portions of the washers from the strung washers.

DOWEL.—C E. EVANS, Weed, Cal There is always difficulty in securing members together by dowels, so that they will remain secure under varying conditions. With this invention this difficulty is overcome for the wedge or end member formed at the end of the dowel serves to spread the dowel, and force it into the member at the sides of the hole.

FILE CASE.—J W PENNEWILL, Silver City New Mex This case has adjustable means for positioning holding and indexing the contents thereof whereby the contents of the case while at all times freely accessible and removable will when in the case be held compactly and in proper position therein

HARNESS SADDLE.—L F C. HAVERLAND and J H THOMAS, respectively of O Connell and Archer streets, North Adelaide South Australia Australia This invention relates in particular to the attachment of the pad to the flap of the saddle The pad is detachably attached to the flap of the saddle by means of fasteners which can be released and resecured as often as may be necessary for any purpose as for instance to enable repairs to be effected

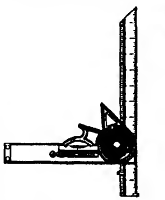
STOPPING AND POURING DEVICE FOR BOTTLES INCLOSING GASEOUS BEVERAGES.—M LANGLOIS Domaine de la Cressonnière at Pont l'Evêque Calvados, France By means of this invention the insertion of the pouring tube can be readily done there is no risk of the tube being obstructed by cork, it can be given a greater diameter than heretofore without inconvenience, moreover, the device can be quickly withdrawn from the bottle before the latter becomes empty and put on another bottle without loss of time, which, in a café or other drinking saloon, allows of greatly reducing the number of the pouring devices used

CRATE FOR METAL CYLINDERS.—L. WESLIN, 2815 Grays Ferry Road, Philadelphia Pa By means of this invention a crate is provided having a maximum of strength with a greatly reduced weight. It has a form which permits of long continued use, and constitutes, if desired, a permanent attachment to the cylinder, since the latter may be charged and emptied without the removal of the crate.

NON REFILLABLE BOTTLE.—J S BROOMHEAD, 396 Dean St Brooklyn, N Y The purpose here is to provide arrangements to permit pouring the contents of the bottle on tilting the same and to prevent refilling with spurious goods. To accomplish this use is made of a closure locked within the neck of the bottle and having a self-closing valve a vent and a pouring spout, the last having a cracked joint connection with the neck of the bottle.

Hardware and Tools.

COMBINATION TOOL.—C A NOSSAMAN, Box 300, Fort Bragg Cal This invention comprises a miter square having a pivoted blade with a protractor attachment to indicate the position of the blade a spirit level and scratch awl, a recess or notch in one edge to adapt



COMBINATION TOOL.

the device for use as a center gage and a plurality of means carried by the pivoted blade for marking a mortise on lumber, by the person using the tool

RAZOR BLADE SHARPENER.—C ALTER, 500 E 83rd St. Manhattan N Y N Y The invention provides a blade sharpener which is simple and durable in construction easily manipulated and arranged to permit convenient and quick sharpening of the ordinary razors or the blades of various makes of safety razors.

LOCK.—R. FEOLA 2 E. 120th St Manhattan, N Y N Y This invention refers more particularly to a lock which comprises any suitable key-controllable mechanism including a bolt actuated member a casing, a bolt therein, means for operatively connecting the bolt and the actuating member, and means whereby the connecting means can be rendered inoperative to adapt the bolt for manual operation independently of the key controllable mechanism.

BIT AND HOLDER.—J W JOHNSON 514 Third Ave Leavenworth Kan. The object of the invention is to provide a bit holder or brace chuck arranged to facilitate the exchange of different bits, to securely hold bits of different sizes in position and to prevent pulling of the bit out of the socket while the bit is in use.

Heating and Lighting.

INCANDESCENT GAS MANTLE.—A F MILLAN, Mannington W Va Mr Millan's invention is an improvement in incandescent mantles, and has for its object the provision of means in connection with a gas mantle for increasing the light, and for concentrating the rays beneath the source of light.

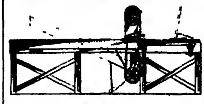
Household Utilities.

WINDOW SUPPORT AND HOLDER.—J W PENNEWILL, Silver City, New Mex The purpose here is to provide a device adapted to hold the lower sash of a window at any desired elevation and a farther object is to provide a device which may be utilized as a lock for the lower sash to prevent it from being raised.

Machines and Mechanical Devices.

AUTOMATIC NEEDLE FEEDER FOR PHONOGRAPHS.—E. C JORDAN, 1111 D St., Sacramento, Cal This invention relates to attachments for phonographs on which removable needles are used, and it provides a device which will insure the least possible delay and trouble in making the renewals of the needles. By the use of this device there is little or no excuse for not renewing the needles according to the highest demands.

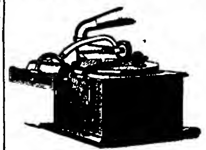
DUMP AND SAFETY LOCK THEREFOR.—H A. WORKHOVAN and J L. BOUMA, Orange City, Iowa. This invention relates more particularly to elevator dumps, and more especially to that class of dumps employing rockable timbers in connection with a dump platform, the timbers being spaced to receive the



DUMP AND SAFETY LOCK.

wheels of a wagon, and to drop under the weight of the load.

SOUND REPRODUCING MACHINE.—C. RAMOS Ellis Island, New York, N Y Among the principal objects which the present invention has in view are to provide a machine adapted to be operated by records of different shapes, to provide an attachment whereby the usual disk-operated machine may be utilized

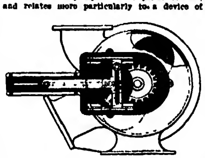


SOUND REPRODUCING MACHINE.

for sound reproduction of cylindrical records, and to provide a simple mechanism for operatively connecting said attachment to the disk machine

Prime Movers and Their Accessories.

PUMP AND PRIME MOVER.—C F NORSMARK 91 W Neptune St West Lynn, Mass. This invention has reference to machines capable of use as pumps and as prime movers, and relates more particularly to a device of

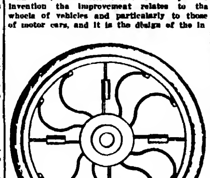


PUMP AND PRIME MOVER.

this class which comprises a casing having an inlet and an outlet, a rotor in the casing a movable abutment adapted to co-operate with the rotor, and an operative connection between the rotor and the abutment, and located at the outside of the casing

Pertaining to Vehicles.

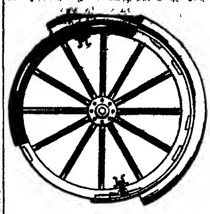
RESILIENT WHEEL.—H LAFLEUR, 175 Mechanic St, Leominster Mass. In the present invention the improvement relates to the wheels of vehicles and particularly to those of motor cars, and it is the design of the inventor to improve in various particulars wheels



RESILIENT WHEEL.

of the general character indicated to the end that efficiency in operation may be promoted, as well as economy of manufacture and simplicity of construction.

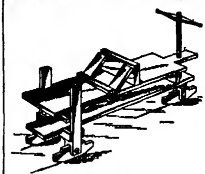
VEHICLE WHEEL.—A SCOTT, care of W C. Vandewater, care of First National Bank Building, Princeton, N. J This invention provides a wheel with a fixed rim having recesses in its periphery in which plugs on a rim are normally disposed, the plugs being held normally against rotation relatively to the fixed rim by catch members which, at the will of the operator, may be moved out of the path



VEHICLE WHEEL.

of the plugs, so that the rim may rotate relatively to the fixed rim where the plugs are disposed at the lateral openings in the fixed rim to permit removal of the rim from the fixed rim by moving the rim laterally relatively to the fixed rim.

SLED.—J J WHEELER, West St., Gardner, Mass. This invention relates to sleds and has for its object an inexpensive, compact sled, light in weight and compact in construction, which can be used on level ground, as well as on hills, which can be easily steered, and,



PORTABLE SLED.

when necessary, transported by the rider This is accomplished by providing a frame mounted on runners, one of which is steerable, and a seat on the frame having a collapsible back rest, which has means for facilitating the transportation of the sled by the rider

Designs.

DESIGN FOR CARPET OR RUG.—J L. FOLSOM, care of G S Squire 25 Madison Ave, New York, N Y In this ornamental design for carpet or rug, the border is composed of three bands, and the center of up and down and across double and curving lines that form irregular shaped spaces filled with cross-hatching.

DESIGN FOR CARPET OR RUG.—H A. HOWE, care of G S Squire, 25 Madison Ave., New York, N Y In this ornamental design for carpet or rug, the border is composed of an outer and an inner band, between which is a wide band of geometrical figures. The center is composed of squares and oblongs of different sizes and a large centerpiece with four corners and four intermediate points.

DESIGN FOR CARPET OR RUG.—J G PROBL, care of G S. Squire, 25 Madison Ave., New York, N Y. In this ornamental design for carpet or rug, the border is narrow and sparsely dotted. The interior depicts a farmyard scene with a horse and colt, chickens, dog and small girl with a toy-horse.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., INC.

Inquiry No. 9298 Wanted the names and addresses of concerns who can turn irregular shaped handles in wood, similar to gun-stock work.

Inquiry No 9299 Wanted name and address of the maker of a machine for driving fence posts into the ground.

Inquiry No. 9300 Wanted the name and address of a maker of a patented keyless door lock

Inquiry No. 9301 Wanted the names and addresses of a few concerns who can do machine embroidery according to the design furnished, at reasonable rates.

Inquiry No. 9302 Wanted the address of the manufacturer of the Greenfield flexible armored conductors or cables. This is a double galvanized, spiral conductor or cable.

Inquiry No. 9303. Wanted the name of manufacturer who could make newly patented articles made from 13 to 28 gage sheet aluminum.

Inquiry No. 9304 Wanted the names and addresses of manufacturers of a second hand bag cleaning machine on the order of a carpet cleaning machine.

Inquiry No. 9305. Wanted the name and address of concerns making paper letters and figures.

Inquiry No. 9306. Wanted small hardware and other specialties to be sold in notion and grocery stores. Wanted to buy wholesale

Inquiry No. 9307 Wanted to buy a machine for honing and stropping safety razor blades on a commercial scale.

Inquiry No. 9308. Wanted woven glass fabric for manufacturing purposes in large quantities. The glass is spun.

Inquiry No. 9309 Wanted to buy small woven tubing of small diameter for use over the temples of spectacles where they go around the ears.

Inquiry No. 9310. Wanted addresses of manufacturers of good selling articles for mail order business catering to the trade of agents.

Inquiry No. 9311. Wanted names and addresses of manufacturers of beads made of colored glass, also medals of all shapes.

Inquiry No. 9312. Wanted to buy a machine which will pick up [illegible] Must be operated by electricity and be [illegible]

Inquiry No. 9313 Wanted to buy Leather [illegible]

Inquiry No. 9314. This [illegible]

NEW BOOKS, ETC.

WATER. Its Purification and Use in the Industries. By William Wallace Christie. New York D. Van Nostrand Company, 1912. 8vo.; 219 pp., illustrated Price, $2 net.

The material of this work is a compilation of the apparatus and processes in practical use for the purification of water The distinguishing features of each machine are admirably picked out by the aid of diagrams and colored inserts There is much in the way of general information also, and there are numerous tables that cannot fail to be of use to engineers and manufacturers. Water softening pressure filters and aeration, and the measurement of water, are some of the other headings under which the author writes. Tables, equivalents, and definitions conclude a well-written and informing work.

VOLCANOES. Their Structure and Significance. By T G Bonney, Sc D, LL.D, F R S New York G P Putnam's Sons. 8vo, 380 pp, illustrated Price, $2

While Prof Bonney has little, if anything to say that has not been said before, he has given us a work at once scholarly and entertaining, which in this third edition presents certain alterations and additions that enhance its value by bringing it up to date. Especially is this true in regard to the sixth chapter dealing with the theories of volcanic action in which the inferences resulting from modern study are indicated The destructive eruptions of the Soufrière in St. Vincent and Mont Pelée in Martinique have made these volcanoes the objective of scientific investigators, and the results of their study have been incorporated into the present edition.

GAS ENGINE PRINCIPLES With Explanations of the Operation, Parts, Installation, Handling, Care, and Maintenance of the Small Stationary and Marine Engine, and Chapters on the Effect, Location, Remedy, and Prevention of Engine Troubles. By Roger B Whitman New York D Appleton & Co, 1912 12mo, 248 pp, illustrated Price, $1 50 net

The sub-title is a sufficient indication of the scope of the work which is well and profusely illustrated and set up in such clear type and with so careful an attention to appearance, that it is a pleasure to run over the pages. The inexperienced owner can not fail to absorb from this text-book information that will greatly alleviate his troubles. The work is unencumbered by any discussion of design or by comparisons of the merits of various constructions.

GAS POWER. By C F Hirshfeld, M.M E, and T C Ulbricht, M M E New York John Wiley & Sons, 1913 8vo, 209 pp; 60 figures Price, $1 25 net.

This is an elementary treatise in which the problem of the heat engine is discussed, the principles of external and internal combustion are set forth, and such subjects as historical development fuels methods, accessories types, and practice, all receive consideration. It is the manual training school student and others of limited technical education, toward whom the text-book is directed.

THE GAS TURBINE Theory, Construction, and Records of the Results Obtained from Two Actual Machines. By Hans Holzwarth Translated by A P Chalkley, B Sc. With additional notes by the Author Philadelphia J B Lippincott Company, 1912 8vo, 140 pp, 142 illustrations. Price, $2 50 net

The author spent three years on the development of a practical gas turbine, and his solution of what he truly calls an important technical problem is very adequately set forth in this translation Part I of the work deals with description and theory Part II with construction Part III draws a general comparison between the gas turbine and the reciprocating engine, first treated thermodynamically and afterward from the point of view of construction and operation. Part IV deals with the results of tests.

STEAMSHIP CONQUEST OF THE WORLD By Frederick A Talbot. Philadelphia J B Lippincott Company 8vo., 344 pp, illustrated Price, $1.50 net.

The author has given us quite an enthralling story of the development of water transportation. The North Atlantic is naturally the predominating scene, since the fight for maritime supremacy here wages the fiercest The general reader may learn while at the same time being thoroughly entertained of the operations of ship building from the laying of the keel to the launching of the monster liner The luxury of the modern passenger vessel is strikingly shown in pictures of the appointments and fittings of such carved, paneled and painted halls as are found in the "Deutschland, the "Mauretania," the "Olympic," and their kin. The great fresh-water liners are also pictured and described, and steamless ships furnish an interesting chapter

STEAM BOILERS. Their Theory and Design. By H de B Parsons, B S., M E New York: Longmans, Green & Co. 1912. 8vo, 377 pp.; illustrated. Price, $4 net.

This fourth edition of a favorably-known work makes its particular bid for notice on the fact that it covers the most perplexing points to be found in practical office work. The reader's acquaintance with boiler-shop practice is taken for granted. The work surveys its field with a great degree of thoroughness, and its merits have been recognized by students and by the engineering profession.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Steel Bodies for Motor Trucks

By Morris A. Hall

AMONG the things that the motor truck has inherited from horse-drawn wagon builders is the wooden body. But repeated experience has shown that this material does not last as it should under the changed circumstances, the heavier loads, the greater speeds, the longer working hours, combine to make the body suffer greater stresses, and wood, under them goes to pieces rapidly. This situation has brought about a demand for metal bodies. The first of these, and many built since and being built to-day, are not an unqualified success. The reason for this lies in the fact that they are put together with bolts or rivets, which do not withstand the stresses imposed by truck work a great deal better than bolts or screws on the wooden form.

More recently, a process has been developed for producing steel bodies, which includes the use of various successful welding processes in combination with the highly-developed pressed steel as a material. The latter is much lighter than ordinary rolled steel sheets of equal strength, while the welding processes unite the members as firmly as the component parts of each sheet. The result is a lighter, stronger, longer lived body of lower first cost when built in quantity, lowered maintenance cost due to lessened depreciation and less tire wear resulting from lowered weight.

Truck manufacturers recently have agreed upon standard body and total weights for given load capacities, basing their figures upon wood bodies. Now, if steel be used a saving results which may be taken advantage of in one of two ways, the load may be kept the same and the lessened tire and other wear taken advantage of, or the load may be increased by the amount saved on the body weight. When 400 pounds can be saved on a 5-ton truck body the standard weight for which is but 1,400, this much may be added to the usual 5-ton load, amounting to 4 per cent. On heavier vehicles, where the body weight in wood runs up more rapidly, the saving is much greater, running above 5 per cent of the load.

It is said the wear of rubber tires varies as the square of the load, the speed remaining constant. On this basis, a 5 per cent saving in body weight would be about 10 per cent saving in tires. The usual mileage guarantee being 8,000 miles, this means the addition of 800.

The exact life of the steel body is not known, but may be inferred in this manner. A Brooklyn builder following the wagon method of riveting and bolting steel plates and structural forms together, has many in use which have seen 14 years' hard service in New York city, hauling coal, than which nothing is more severe. They seem good for some years more now, and granting that welded pressed steel bodies are twice as good the latter should give over 30 years' service. The life of an ordinary wood body does not average much over 6 to 8 years, although there are exceptional cases in which they have lasted, through light work, twice as long.

An advantage in favor of wood at first was the matter of painting, it was extremely difficult to get paint to stick to steel sheets, the result being that they had to be painted often to prevent rusting and the quick destruction of the body in that manner. In the welded pressed steel forms mentioned the bodies are enameled, and the enamel is baked on, so that it is as hard as porcelain and cannot be chipped off even with a hammer.

The nature of the materials used in the trade which employs the truck has a huge influence. Take the brewery delivery service for instance, the kegs have iron chimes or bands which rust down to a very thin edge. Thus they have a cutting property. They are put in and taken off the wagon rapidly. As a result the rungs, posts, rails and other parts of the body are quickly cut up, and soon require repairing. So great is the need for this that the largest brewers, such as Ehret, Ruppert, Ringling, Central, Lion, and others in New York city, maintain a large and well appointed repair shop which does nothing but repair the bodies. With the motor truck, time spent in the repair shop is a double loss, so this question is of double importance.

The newer forms of steel body would eliminate all this, while the hollow shapes used in the body construction would give greater resistance to sudden blows. The same is true of other firms, the coal body must withstand the water used in wetting the coal as well as the constant erosion of the material sliding in or out. Metal alone will do this, consequently, if wood be used, the body must be steel lined. The same is true for sand and gravel, cinders, broken stone, brick or any similar material. For hospital use especially in handling patients with contagious diseases, it is important that the body may be rapidly and readily cleaned out and fumigated. With wood this is an extremely difficult job. For tank or other liquid carrying bodies, wood has been abandoned, practically, steel taking its place.

And so it would be possible to go through the whole range of uses to which a motor vehicle might be put and prove that for each and every one the steel body has some advantage over wood, sufficiently weighty to warrant its use in preference to the latter.

An Automobile Field Kitchen

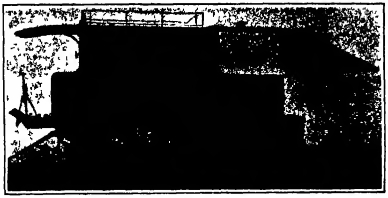
By Our Berlin Correspondent

ONE of the most interesting exhibits at the St. Petersburg Automobile Show, which opened on May 18th, is an automobile field kitchen. This is mounted on a vehicle of 2½ tons carrying capacity attached as trailer to an automobile tractor.

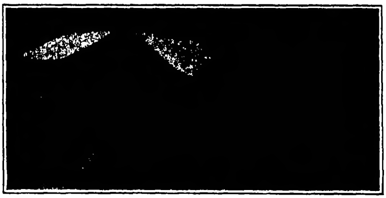
The front part of the vehicle, immediately behind the driver's seat, comprises to the right and left two large fireless stoves each of a capacity of 60 liters (15.85 gallons), above which there are a number of pigeon holes for preserves, bread, etc. The rear part of the vehicle is taken up by the field kitchen proper, which mainly comprises a double walled steam kettle of about 200 liters (52.8 gallons) capacity. The space between the double walls is filled with glycerine, which on one hand protects the dishes against any risk of burning, and on the other hand allows the contents of the kettle, after putting out the fire, to go on cooking on the well known fireless cooker principle. This is the more important as the smoke given out by the fire might draw the attention of the enemy to the troops encamped in the neighborhood. The glycerine bath allows the contents of the kettle to be kept hot for about 6 to 8 hours. In addition to the main kettle there are arranged sideways a coffee kettle of 20-gallon capacity with a special fire-place, reservoirs for storing the apparatus used in preparing the dishes, spices, coffee, and the like. The kitchen gases from both fire-places are discharged through a common chimney.

This kitchen has been designed to prepare within 2½ hours food and coffee for about 200 to 250 men. As soon as the contents of the kettle are ready, it is transferred into the [illegible] stoves to be taken in them to the men in the field. It is thus possible in 24 hours to feed about 2,000 men. The kitchen, by the way, is very economical in operation, only about 18 to 22 kilogrammes (8 to 10 pounds) of wood being required for preparing the food for 200 to 250 men, while any other fuel available in the field can be used as well.

This field kitchen can be mounted on an automobile truck instead of on a trailer, thus allowing the motor to be used at the same time for the operating of kneading and chopping machines, etc., which are readily stored on the vehicle. However, the field kitchen car would in this case not be available for other uses, whereas the automobile tractor is advantageously employed for carrying such provisions as cannot be placed on the trailer.



An automobile field kitchen for the Russian army.



Rear of the trailer, showing the kitchen proper; also the motor tractor in which provisions are carried.

Tar Bonded Roads in Cincinnati

CINCINNATI is the scene of a number of important successful road contracts where the macadam has been rendered automobile-proof by the use of a refined tar binder. This was one reason why the American Road Makers' Convention was held there in 1912.

Madison Road, the sole eastern thoroughfare in the city, affords the oldest instance of tar bonding. It carries a traffic so heavy that a contractor who took a traffic record, reported that macadam could not be used at all.

In 1907 the north side of this road was resurfaced with tar bonded macadam to afford a comparison with native rock asphalt and plain macadam. Within a year the tar bonded section had so clearly demonstrated its superiority that the property owners petitioned for more of it, and in 1908 the remainder of the road was accordingly reconstructed with the tar. Since then the road has been uniformly in excellent condition and has cost nothing for maintenance except a little patching and a partial treatment with a surface coat of a thin grade of tar.

Erie Avenue was bonded with tar in 1908 and required no attention until 1912, when several holes were repaired and the surface was given a renewal treatment with tar. Before the use of tar binder, this avenue had required resurfacing every six months.

Observatory Road, another important thoroughfare, had been impossible to maintain in even reasonably good condition previous to the use of a tar binder in 1909. Since then it has been in excellent condition and required no attention until it received a surface treatment in 1912.

Grandin Road, another heavy traffic street, had required resurfacing twice a year until in 1907, when it was bonded with tar. After that one surface treatment with tar was enough to keep it in good shape.

The tenacity of the tar bond was interestingly illustrated on Hillside Avenue in 1912. On a steep hillside section there was a landslide which shifted the foundation of the road. The tarred surface, however, instead of breaking, stretched and twisted very much as if it were a big sheet of rubber.

In 1911 Cincinnati abandoned the use of plain macadam on all main thoroughfares and substituted the tar bonded type of construction.

An Acetylene Storage Tank.—A patent has been issued to the [illegible] Company, of Chicago, as assignee of Joseph Hidy James of [illegible], for an acetylene storage tank, No. [illegible] [illegible]

Dussaud's "Cold Light"

(Concluded from page 489.)

other words, an apparatus so small that it can be carried very easily in the hand. The absence, or rather the quick dissipation, of heat enables the operator to run the film off as slowly as he pleases and even to stop it entirely in order to study one particular picture on the screen.

Because of this rapid dissipation of heat, it is possible to employ celluloid instead of glass plates for ordinary lantern slides. There is no danger of setting the celluloid on fire or of causing it to shrivel up. Dussaud confidently prophesies that with his cold light it will be possible to use celluloid films ¾ of an inch by 1 inch in size instead of glass plates 3¼ by 4 inches. The celluloid can be cut into long strips, perforated along the edges so that it can be printed mechanically, as in making moving picture positives. Indeed, Dussaud claims that a single operator can make twenty five thousand celluloid prints a day. These tiny photographs can be made by any amateur at a cost of not more than a cent, and can be projected on the screen by means of small, cheap projectors (Fig. 1)

Opaque bodies, postal cards, illustrations in books, and other objects can be directly thrown upon the screen in enlarged form by reflecting lanterns. The image, which appears in all its colors, relief, etc., on the canvas is 3½ yards square. Two lanterns can be employed when dissolving views are to be projected, in which case it is not necessary to employ the usual shutters, but simply to rely wholly on the commutators of the apparatus (Fig 2)

By means of cold light auto-chrome plates can be projected, which otherwise suffer when exposed to the electric arc. Powerful lights can be concentrated upon parts of the human body without danger of scorching them, with the result that foreign bodies can be located very readily in the muscles. The hand, when held close to a powerful cold light, appears translucently pink.

As one of our photographs shows, the cold light can be employed in photographing interiors. The inconveniences attending the use of ordinary magnesium flash powder are well known. Powerful cold lights render it possible to make very brief exposures without polluting the atmosphere of the small room with smoke.

With a small electric battery and a simple lens, a beacon light of long range can be cheaply produced. Such an apparatus will be found serviceable on small sailing boats as well as by soldiers. It is easy enough with such a device to telegraph optically for great distances.

Disposal of New York's Sewage

(Continued from page 490)

tical experience. It is only the combination that is new. The water within a mile of the island in all directions varies from 7 to 40 feet in depth, the average being about 20 feet below mean low tide. The form of the island is shown in our front page illustration. It will cover about twenty acres. It is planned to build a rip-rap wall by laying large pieces of broken stone at the site upon the hard sandy bottom. As the water cuts away the sand from under the stone, more stone will be added until settlement ceases. Within the wall sand will be poured from a suction dredge. As the water is shallow, no serious difficulties will be encountered in the filling operations. The island will be about 18 feet above mean low water, 1,000 feet wide and 1,200 feet long. It is estimated that the island may be constructed for about $615,000. At the landward end of the island there will be a small harbor for the tank steamers that are to carry the sludge out to sea. A shelter will be provided by a breakwater.

The tunnel under the bay will be 14 feet in diameter. Starting with the siphon under the East River, it will be 8 feet 9 inches in diameter and will be blasted out of solid rock at a depth of 110 feet. After passing under the river it will rise to a level of about [illegible] feet and here will

have a diameter of 10 feet 3 inches, then at the Wallabout pumping station it will rise to sea level and will run from there to the junction of the Jamaica Bay interceptor with a diameter of 12 feet 8 inches. The siphon under the East River will be about 2,900 feet long. It will be purposely made of small diameter so that there will be sufficient velocity of flow to prevent the deposit of solids. If the Manhattan interceptor is extended it will be necessary to build a second siphon parallel to the first. It is considered necessary for the velocities in the siphon to range between 2 and 5 feet per second.

The general pumping station at Wallabout will be able to handle two hundred million gallons a day. The sewage here will have been passed through settling chambers and will be in a reasonably fresh condition. The pumps will have to raise the sewage and pump it under a head of about 18 feet to the artificial island. The island will be about 11.8 miles from the pumping station.

At the outlet island the sewage will be delivered into settling tanks. The proposed construction of these tanks is indicated in the accompanying drawing. Each tank is formed with inverted pyramidal settling basins. Between the tanks are conduits through which the sewage flows. Every other conduit *A* is an influent. Running from these conduits are pipes *B* that deliver the sewage near the bottom of the settling basins. The solid matter collects in the form of sludge at the bottom of the basin where it is subjected to a certain amount of pressure due to the head of the liquid matter causing it to be forced up the discharge pipes *C* into the mains *D* whence it will be forced in to the tank steamers either by the head of liquid in the settling tank or if this is not sufficient by low pressure pumps. If necessary the liquid sewage matter will be treated to render it harmless and then it will overflow into the conduits *F* and pass out through discharge pipes under sea level on the seaward side of the island. The discharge pipes may be extended far out to sea if it be found desirable.

At this island 200,000,000 gallons of sewage could be taken care of, or about one third of New York's present sewage. A thousand tons of sludge would be removed daily.

Don, the "Talking" Dog

By Dr. Leonard Keene Hirshberg, A.B., M.D. (Johns Hopkins)

DR. HARRY MILES JOHNSON of the Johns Hopkins University has just announced the result of his analysis of "Don," a German setter seven years old, belonging to the royal game warden Ebers at Theerhutte in Gardeldgen. Numerous other observers report that he has a vocabulary consisting of eight words which he speaks if food is held before him, and the following questions propounded in German: "Was heisst du?" "Don." "Was hast du?" "Hunger." "Was willst du?" "Haben, haben." "Was ist das?" "Kuchen." "Was bittest du dir aus?" "Ruhe." Moreover he was said to answer categorical questions by "Ja" and "Nein" and in reply to another question to speak the name "Haberland." Among others whom popular report mentioned as witnesses to this extraordinary ability of the dog was Mr. Oskar Pfüngst of the Psychological Institute of the University of Berlin, whose important tests on the horse of Mr. von Osten, "Der Kluge Hans," have lately been published in English. Mr. Pfüngst had in fact investigated the behavior of the dog in collaboration with Prof. Vosseler and Dr. Erich Fischer, keeping detailed memoranda on the tests and making a number of phonographic records. Partly to clear up misapprehension of his own position and partly for the enlightenment of the serious general public he gave out a brief popular report of his work.

Having proposed three definitions of speech: first, properly, as the use of vocal sounds to convey to the listener an idea experienced by the speaker; secondly, more loosely, as the production of vocal sounds learned by imitation, but used without knowledge of their meaning to the hearer; and, thirdly, as the production of vocal sounds not imitative of human speech having no meaning to the speaker, but producing in the hearer illusions of definitely articulated spoken words, uttered to convey meaning, Mr. Pfüngst then asks to which class the speech of Don properly may be referred.

First, it is plain enough that the dog does not use words with any consciousness of their meaning to the hearer. His vocabulary is always given in order, beginning with "Don" and ending with "Ruhe." If the order of questioning is varied he is called "Kuchen" and he desires "Hunger," etc. (Here it may be noted that the author was unable to get even approximations to the last three words in the list accredited to the animal.)

Secondly, it is evident, says Mr. Pfüngst, that he is not using words learned by imitation. The author assumes that any imitator of another speaker would vary the pitch, intensity or accent of his words as the imitatee's were varied. Don's voice—a high tenor ranging from *f* on the bass clef to the octave above middle *c*, usually pitched in talking near *d* above middle *c*—is not varied when the pitch of the questioner's voice is altered. Furthermore he does not imitate changes in accent or intensity. He is as likely to say "*Auchen*" as "*Kûchen*," "*Hunger*" as "*Hûnger*," etc. From the legitimacy of the author's adoption of this criterion however the reviewer is inclined to dissent. His own experience with a child of two and one half years, learning readily to speak a large number of words and phrases from imitation and able to give both vowel and consonant values with perfect distinctness, showed that for several months she could not be made to change intensity or pitch, although she usually showed apparent willingness to try. To apply this principle in the case of the dog would require the assumption of an attentive ability as well as of motor skill far in excess of any of which that animal has given evidence.

But Mr. Pfüngst offers other disproof of the imitation hypothesis which seems really adequate. This is found in the method of learning. The first word which the dog is reported to have uttered is "*Haben*." We are assured that being asked "Willst du etwas haben?" he thereupon pronounced distinctly the words "*Haben, haben, haben*," and was rewarded with food for his pains. When he afterward attempted to pronounce the words he would give many inarticulate gurgles, but the food was given only when the correct number of syllables were uttered at once. The family state that ten repetitions, some a week apart, sufficed for this learning. The word "*Ruhe*" was first uttered after a command "*Ruhe*" by the owner's daughter. Hearing the dog's response, she demanded "Was sagst du da?" and obtained the answer again, "*Ruhe*." He was then taught to give this word after his fifth question, "Was bittest du dir aus?" The name "*Haberland*," which none of the investigators could obtain from him, was first answered without instruction to the question, "*Wer hat den ersten Artikel über dich in die Zeitung gebracht?*" These facts are hardly consistent with any probable experience in learning by imitation. Indeed it may be remarked that to one who has spent the greater part of two years in experimentation on behavior of the dog under controlled conditions, the animal's vagueness of perception and extremely low degree of attention would make a very strong presumption against the possibility of his learning even the simplest acts by observation and imitation.

Mr. Pfüngst concludes that the speech of Don is therefore to be regarded properly as the production of vocal sounds which produce illusions in the hearer. He calls attention to the fact that not even the number of syllables in any given "word" of Don's is constant. The dog makes only one vowel sound, having a value lying between *o* and *u*, varying considerably but usually nearer *u*. The experimenters could not hear from him certainly either *a* or *e*. His one guttural-aspirant is like the German *ch*, and does duty for *k* and *h*. There is also a nasal, of a value lying between *n* and *ng*. When it is not prolonged it passes for a *d*,

"*Don*." He really never makes the sound of *b*, *d*, *k*, *l* or *r*. When he utters a word expressed by *ch* | *ungue*, not much effort is required from a suggestible hearer to perceive the sound as "*Hunger*." When in making phonograph records the questioner asks merely "Was?" the dog gave the customary answers, "*Don*," "*Hunger*," "*Haben, haben*," "*Kuchen*," etc., of which however only two out of sixteen answers were intelligible. Of one hundred and sixty-eight answers preserved on phonograph records, seventy-one per cent were disyllabic, and of the monosyllabic noises sixty-eight per cent were given when a considerable pause had elapsed between the last answer and this question. The "answers" were really incorrect fully as often as otherwise. Disinterested hearers could seldom distinguish his "*Hunger*" from his "*Haben*," or his "*Ruhe*" from his "*Kuchen*," etc. It was as easy for others to perceive some of these same sounds as "*Engelhopf*" or "*Hallelujah*," "*Huhn*" or "*Honig*." Here it seemed to the author we have a case quite parallel with our common interpretation of the night-swallow's calls as "whip-poor-Will," when in fact the sounds are nearly "Pñf-ah-rih," and with the common German interpretation of their *Steinkauz's* "*kuwitt*" or "*kuwiff*" as "*komm-mit*," thus making him in popular superstition the messenger of death. But for a strong and uninhibited tendency thus to "apperceive" them, neither these calls nor the 'words' of Don would be taken as other than meaningless noises.

On psychological grounds, Mr. Pfüngst concludes, the explanation is comparatively simple: the uncritical do not make the effort to discriminate between what is actually given in perception and what is merely associated imagery, which otherwise gives to the perception a meaning wholly unwarranted, and they habitually ignore the important part which suggestion always plays in ordinary situations.

These explanatory truths being accepted we may expect the majority of animal lovers to continue to read their own mental processes into the behavior of their pets. Nor need we be astonished if even scientists of a certain class continue at intervals to proclaim that they have completely demonstrated the presence in lower animals of "intelligent imitation" and of other extremely complicated mental processes—inferred from the results of brief and lamentably superficial tests, and published as proven facts without further reflection.

Naphthalin as a Binder for Anthracite Briquettes

THE pitch commonly used as a binder in making briquettes of anthracite is rather dear; hence a cheaper substitute has long been sought. Naphthalin, another by-product of the coke-ovens, is specially fitted for this purpose, and many experiments have been made with the object of evaporating it and mixing it intimately with the particles of coal by means of superheated steam.

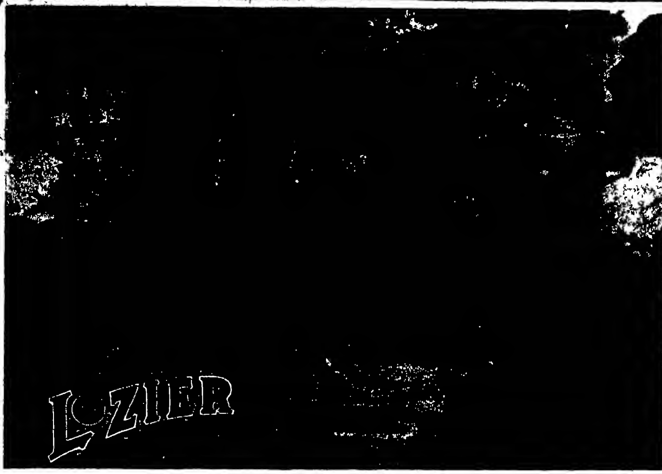
The process proposed by Buss-Fohr has hitherto not been very successful, but recently, according to *Glückauf*, it has been considerably improved by Schürer and made practically useful.

The naphthalin is melted in a melting pot by steam at about 100 deg. Cent. and then led into the coil of an evaporator in precisely measured quantities. The coil is played upon by superheated steam at 300 to 350 deg. Cent., so that the naphthalin in the coil evaporates.

The steam issuing from the evaporator drives an apparatus which sucks the evaporated naphthalin out of the coil and forces it into the steam kneading apparatus filled with coal, where the two are thoroughly mixed.

Actual experiments prove that by using a percentage of naphthalin in place of the pitch a saving of 0.5 M. per ton is effected.

In this connection it may be mentioned that naphthalin is also finding an application as fuel for combustion motors. According to *La Nature*, at the Creusot works a 70 horse-power naphthalin engine is being built for use on the Siberian Railway.



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The "LIGHT SIX" $3250

—*over 62 actual horse power*—

PURCHASERS of the Lozier "LIGHT SIX" say there is not a *competing* car sold at within a thousand dollars of the price. We believe this opinion is a perfectly sound opinion.

One would naturally expect the opinion of such men as buy Lozier cars to be a sound opinion. For, universally, they are men who *know* motor car values. Mostly they are men who have owned a great many cars. Many of them had opportunity to compare Lozier quality, in all its phases, with the quality of the finest foreign cars. *All* of them are conversant with the relative values of American made cars. Their opinion is *worth while to you.*

Look at it from any viewpoint and you cannot but recognize the unusual value of the Lozier "LIGHT SIX." For $3250 here is the first car of very highest character ever sold at a medium price.

It's a price that has brought Lozier quality within reach of thousands of people who for years have *wanted* Loziers but didn't feel they could afford to put $6000 into an automobile.

The ready sale of "Light Sixes"—taxing the capacity of our two great plants—shows that the public sees the *economy* of a Lozier for $3250.

Ever since the "LIGHT SIX" was first announced last winter, there has been no let up in the call for this Lozier at less than $5000 But that is not surprising. For the "LIGHT SIX" has all the engineering excellence, the same superiority of materials and the same accuracy of workmanship that have made the name Lozier a stamp of satisfaction in motor cars.

It has not one year, or two or three, of six-cylinder experience back of it, but six years. Experience that *counts!* It is a *perfected* Six.

The "LIGHT SIX" has genuine Lozier power, too, and characteristic Lozier *reserve* strength. You will do well to place your order for a "LIGHT SIX" at once. There are purchasers *waiting* all the time, though dealers and purchasers alike comment kindly on our promptness.

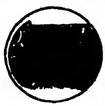
Five beautiful types of body are built on the "LIGHT SIX" chassis Touring Car, $3250, Roadster, $3250, Coupe, $3850, five passenger fully enclosed Limousine, $4450, six passenger semi-fore-door Limousine, $4450

Lozier Style

The Lozier is the most *distinctive and distinguished* car you meet on the road. Just as distinctive in its style—and just as distinguished—as in its mechanical excellence.

Lozier Control

The ease of Lozier control, the comfortable accessibility of everything you use in running the car, is an interesting feature of all Lozier models.



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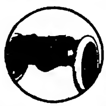
Many who are in a *position* to *know* have said Lozier is the strongest car in the world. Many have said, "You can't wear out a Lozier"



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Soft, thick cushions do not *insure* comfort. But in the Lozier they are one of *many* contributing comfort factors. Such comfort as Lozier comfort cannot be found in any but a Lozier car

Lozier Equipment

You will be pleasantly surprised by the equipment of the Lozier "LIGHT SIX." Everything you could *ask* for is there—all equipment is of the high Lozier quality

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SIXTY-NINTH YEAR

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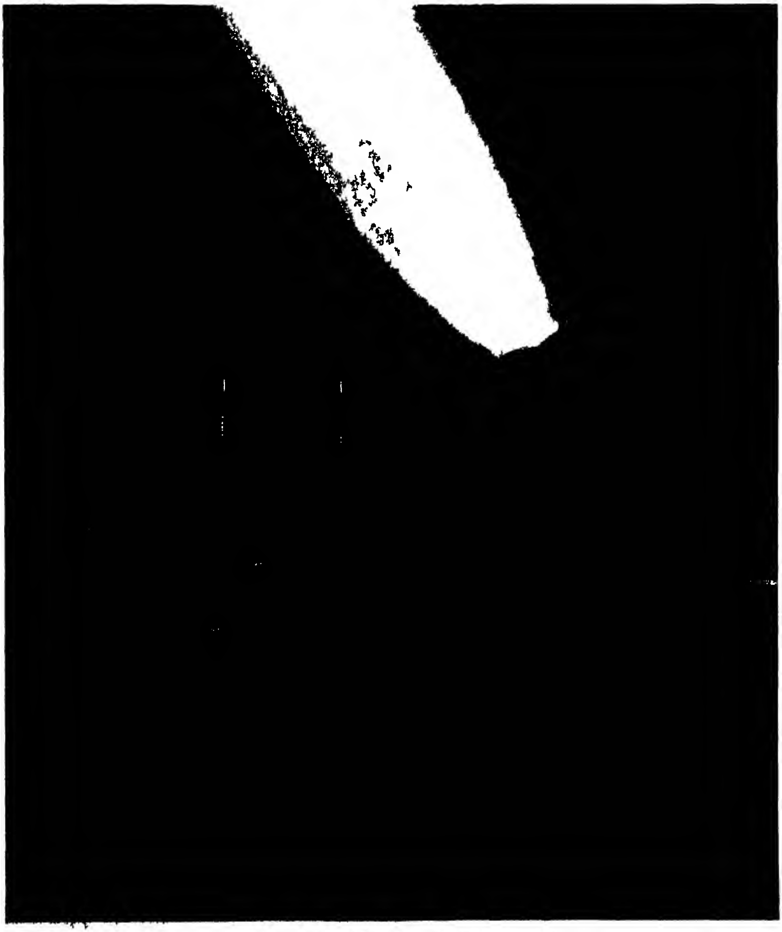

BLOWING A HEAT IN A BESSEMER CONVERTER.—[See page 516.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply and interestingly, the world's progress in scientific knowledge and industrial achievement.

Price Maintenance and the Supreme Court Decision

FORTIFIED by numerous decisions of the lower United States Courts, manufacturers of patented articles have been led to believe that the "exclusive right . . . to vend" an invention, conferred on patentees by our laws, could be interpreted to mean the right to fix the price at which the invention was to be retailed. The Supreme Court of the United States has now decided that when he parts with the title to merchandise embodying his invention, the patentee may not enforce restrictions intended to prevent the buyer from selling at any price.

We have no reason to question the legal wisdom of this momentous decision. But business men will surely voice another strong protest against a system of legal procedure which has only at this late day enabled them to learn the definite meaning of the words "exclusive right . . . to vend." A less cumbrous and expensive court procedure would have given them this important interpretation fifteen years ago, at a time when the relation of price maintenance to distribution first dawned on them, and when they had not yet spent millions and millions in advertising the price at which their safety razors, fountain pens, cameras, and vacuum cleaners could be bought in every country town.

While the Supreme Court doubtless interprets the patent statute fairly, its decision drives home once more the lamentable fact that law and its administration have lagged behind merchandising and its methods. "Let the buyer beware" is still a judicially recognized legal maxim, although it is nowadays considered an abhorrent principle in honorable merchandising to cast all the risk of a sale on the purchaser of an article. "Protect the buyer" is the modern merchant's maxim, but his efforts to make that maxim effective, something more than a moral precept too elevated for the observance of the lowly shopkeeper, are seriously hampered by decisions such as this of our Supreme Court.

No one who is at all familiar with the difficulty of distributing goods efficiently or with the transformation of selling methods brought about by world-wide advertising, supposes for a moment that the resale prices of patented wares will no longer be fixed. Fairness to the public and to himself will compel the merchant to devise selling systems which will prevent the "cut rate" chain and department stores, and the huge mail order houses, from devouring the small retailer's restricted market. The methods adopted by the vendors of trade-marked articles, who had nothing akin to the patent statute to protect them from attacks under the Sherman act, will no doubt be adopted by patentees. Goods will be consigned instead of being sold, agencies will be created, preferential discounts will be given to those who maintain the prices marked upon packages and withheld from those who depart from them, private detective services will be established to unearth price-cutters and their sources of supply. In a word, a dozen different stratagems will be evolved to carry out a well-established, necessary and honorable business practice awkwardly and circuitously instead of efficiently and directly.

The Supreme Court's decision is of peculiar importance to inventors because it vitally affects the established methods of introducing inventions. Every new device, great or small, means a revolution, great or small—a revolution in the way of building so huge a machine as a locomotive or in accomplishing so insignificant and personal a task as shaving one's face. Revolutions are not always welcome. The public must be taught to use the new, revolutionary invention. A whole lake of printer's ink, a veritable Niagara of advertising, was necessary to convince the world that a vacuum cleaner would actually suck dirt out of a carpet and that a piano could be acceptably played with mere air instead of hands. In interpreting the words "exclusive right . . . to vend," the lower Federal Courts seem to have taken these difficulties into consideration, for they have held that a part of the inventor's reward for having devised and frankly disclosed his fountain pen or his talking machine was the right to dictate the conditions under which his invention was to be used and sold. In other words, the expression "exclusive right . . . to vend" was given the broadest possible meaning by the lower courts. The Supreme Court has given them their narrowest possible meaning.

Years of patient, costly experimenting are required to develop an invention to commercial perfection after the grant of the patent in which it is disclosed. The monopoly which the inventor is supposed to enjoy is, in effect, much briefer than the seventeen years legally prescribed. It may be seriously questioned whether the generous idea of those who framed the Constitution—the idea, very novel one hundred and seventy-six years ago, of permitting the creator of intangible brain property to own it absolutely for a limited time and of actually encouraging inventors to devise new machines and processes—ought not to be definitely expressed in a patent statute which will in terms permit the patentee to exercise a reasonable control over his invention after it has left his hands.

The opposition to price maintenance engendered by the decision in the Dick case can be easily enough traced to a vague fear that in some way the practice of fixing retailing terms is akin to trust control. A long, tedious campaign of education will be necessary to dispel that fear, to teach the difference between controlling the market on *all* safety razors and the market on *one* particular safety razor, to prove clearly that the liveliest conceivable competition among makers of patented safety razors prevents any one of them from exacting an exorbitant profit. Many magazine and newspaper articles must be written in order to convince the public that the small retailer will be driven out of business if "cut price" department stores and mail order houses are permitted to sell below cost or at a small profit a well known and meritorious invention to the creating and advertising of which they have contributed absolutely nothing, that this profitless selling destroys the manufacturer's market and ultimately compels the public to deal with the department store and the mail order house of the large city.

Already signs are not wanting that the dangers which lurk in permitting chain stores and mail order houses to crush small retailers by "trust" methods, are to be regarded as a distinct menace. Statutes have actually been passed in Missouri, Indiana, Wisconsin, Illinois, New Jersey, California, and South Dakota, all designed to prevent "cut rate" dealers from undermining the good name and market of a reputable manufacturer, from depreciating the worth of well known trade-marked or patented products in general estimation, and from misleading the public into the belief that other less advertised articles, which they keep in stock, are sold at similar low prices.

In enacting these salutary laws, the States mentioned have but extended the well-established practice of the older European nations. Denmark, a country in which the rights of the small property holder and the small retailer are jealously safeguarded, imposes a heavy fine on the dealer who departs from the price fixed by the manufacturer, and compels him in addition to pay an indemnity. Germany regards the violation of a contract to sell at a certain price as an offense to good business morals. Belgium punishes the price cutter by compelling him to pay damages to the merchant whom he has wronged. France rigorously enforces the conditions of sale imposed by a manufacturer to prevent underselling. Thanks to the sharp protests of many thousand retailers, Canada has been so far induced to modify her equivalent of our Sherman law as to permit the maintenance of prices under conditions which will enable the retailer to exist.

So widespread is this movement to protect the small dealer and the general public, that we may prophesy the extension of the conception of unfair competition to prevent not merely the pirating of a valuable trademark and the theft of another's name and label, but the destruction of the good will and the reputation that great manufacturers have tediously and expensively established by much advertising. That extension may be effected either by Federal legislation or by judicial enlargement of the conception of unfair competition. But though the extension comes soon or late, the effective distribution of personally guaranteed and identified merchandise, whether patented or not, demands the maintenance of the retail price as a necessary and legitimate business principle.

Expedition to the Amazon

WHAT is described as one of the best-equipped exploring expeditions that ever left the United States has been sent by the Museum of the University of Pennsylvania to the Amazon valley to carry on ethnographical and geographical research. The party goes on a steam yacht, 132 feet in length but drawing only 6½ feet of water, so that it will be able to navigate the smaller tributaries of the Amazon for thousands of miles, through a vast territory that is now practically unknown. It is proposed to explore first some of the northern tributaries, which flow from the mountains on the borders of Brazil and the Guianas, next the region drained by the Rio Negro and its affluents, and finally an effort will be made to reach the isolated tribes inhabiting the enormous unexplored forests between the rivers Madeira, Trapajos, and Purus. In each case the steamer will proceed as far as possible up the rivers, and canoes will be used to reach the less accessible headwaters, ultimately, parties will land and penetrate the forests to the native villages. Meanwhile the party in charge of the steamer will carry on geographical and hydrographical surveys. Probably no inhabited region of the world offers a more completely virgin field for exploration than the interior of Brazil, especially as to ethnographical research, and it is expected that the material brought back by the expedition will enable the University Museum to prepare a unique exhibition illustrating the life of tribes that are to-day the most primitive and picturesque of savages. The party is led by Dr. William Curtis Farabee, the well-known anthropologist. Commander J. H. Rowen, U.S.N., is in charge of the yacht.

Evolution and Physical Law

THERE is a common saying that history repeats itself. But science refutes this popular dictum. For it is a fundamental law of physics that any real finite system never passes twice through the same state. Thus in a system comprising a number of bodies at different temperatures, a gradual readjustment will take place by conduction and radiation, in such manner that the distribution of temperature approaches more and more nearly to a uniform state. Never, under any circumstances, will the system, after such equalization has taken place, return spontaneously to its initial state. Time is unidirectional, the past irrevocable.

It is hardly necessary to point out that this is true in the world of living organisms quite as much as in the non-living world. But in biological science the unidirectional character of time has a significance of its own. For the history of a species of living organisms, its *evolution*, is the central problem of modern biology. That species undergo modification, evolution, in the course of time, hardly anyone would question at the present day. But what is the trend of this evolution? The answer is contained in the principle of the survival of the fittest. Evolution proceeds in such direction, that individuals and species less well adapted to existing circumstances give way to species better adapted to them. In the living as in the non-living world, evolution proceeds from forms less stable to those more stable under existing conditions. The problem of discovering the physical law of evolution is eminently a problem of discovering a law of stability, a law of equilibrium. In the physical world the condition of equilibrium can be expressed in the form of a maximum or minimum law. Thus, for example, for a purely mechanical system the condition for equilibrium is that its potential energy shall be a minimum. Similarly for a system subject to irreversible changes, the condition for equilibrium is that the thermodynamic potential shall be a minimum. Is there a similar law applicable to a system in the process of organic evolution? Is there some function which continually diminishes as time goes on, ever approaching a minimum value? Many may have suspected the existence of such a law. Le Dantec in his book "La Stabilité de la Vie" has the boldness to express his conviction of the validity of such a law. But its full substantiation can hardly, as yet, be said to have been established, nor its exact form determined. There is scope for valuable work in this direction. A paper on "Evolution from the Standpoint of Physics," which appears in this week's issue of our SUPPLEMENT, represents an attempt to clear the ground for action in the attack of the problem. There is a small but growing body of workers in the field, a field somewhat difficult of access, because of the peculiar combination of qualifications and interests needed in those who are to cultivate it. A certain familiarity with at least the fundamental facts of biology, a readiness in the use of mathematical machinery, and above all, a thorough grasp of the laws of mechanics and thermodynamics in all their aspects.

Few men to-day combine such a combination of qualifications and interests, and hence, until a special body of workers has been trained especially for the work, progress in what appears to be a [illegible] field for research is likely to be slow.

Engineering

Completing the Culebra Cut.—Two steam shovels working from opposite ends of the Culebra cut at grade met on the afternoon of May 24th. This, of course, does not mean that the excavation is completed, but merely that it has been carried down to grade. Considerable work must still be done to extend the canal to the required width.

Our Dangerous Streets.—During the year 1911, 532 persons were killed by automobiles in the streets of Greater New York. Incomplete records of the injured taken from daily newspapers show 13,042 persons hurt by automobiles, 704 by street cars and 317 by wagons. In London, which in 1911 had a population of over 7,000,000, 410 persons were killed by vehicles, while in Paris, with a population of over 2,000,000, there were 236 deaths and 18,179 injuries, by all classes of conveyances.

The Moffat Tunnel Through the Continental Divide.—At a recent election in Denver, Col., the Moffat Tunnel Amendment was carried by a large majority. This provides for a Tunnel Commission which will arrange for the construction of a six-mile tunnel through the Continental Divide for the Denver and Salt Lake Railroad. The eastern portal of the tunnel will be at Tolland, 35 miles from Denver. The tunnel will be 6.4 miles in length and its cost is estimated at between four and four and one half million dollars. It will reduce the route from Denver to Salt Lake City to 68 miles as against 187 miles by the Denver and Rio Grande route, which is at present the shortest. The tunnel will be open to all western railroads entering Denver. Eventually it will be bought over by the Denver and Salt Lake Railroad, but the city will retain perpetual rights to carry water power through it. Work will be commenced at once and it is hoped that the tunnel and the Denver-Salt Lake Railroad will be completed in 1915.

International Engineering Congress, 1915.—In connection with the Panama-Pacific International Exposition, which will be held in San Francisco in 1915, there will be an International Engineering Congress, in which engineers throughout the world will be invited to participate. The congress is to be conducted under the auspices of the following five National Engineering Societies: American Society of Civil Engineers, American Institute of Mining Engineers, the American Society of Mechanical Engineers, American Institute of Electrical Engineers, and the Society of Naval Architects and Marine Engineers. These societies, acting in co-operation, have appointed a permanent Committee of Management, consisting of the presidents and secretaries of each of these societies, and eighteen members resident in San Francisco. The scope of the congress has not as yet been definitely determined, but it is hoped to make it widely representative of the best engineering practice throughout the world, and it is intended that the papers, discussions and proceedings shall constitute an adequate review of the progress made during the past decade and an authoritative presentation of the latest developments and most approved practices in the various branches of engineering work. The papers, which will be collected and published by the congress, should form an invaluable engineering library, and it is intended that this publication shall be in such form and at such cost as to become available to the greatest possible number.

Aluminium and Magnesium Alloy.—In a paper read before the Society of Automobile Engineers, Mr. Morris Machol gives some interesting data on the aluminium and magnesium alloy known as "magnalium," and describes the successful use of this alloy for the cylinders and pistons of gasoline engines, particularly where weight is an important factor, as in aeroplane work. The specific gravity of magnalium is 2.5, that of pure aluminium 2.56, and of aluminium alloy No. 12, 2.82, while cast iron has a specific gravity of 7.5. Cast iron pistons show a tensile strength of between eighteen thousand and twenty thousand pounds per square inch, while magnalium shows a strength of twenty-three thousand pounds per square inch. It is also very tough, whereas cast iron is rather brittle. Magnalium is an excellent bearing metal, showing at 280 revolutions per minute and 250 pounds per square inch, a coefficient of friction of 0.0056 as against 0.0075 of babbitt and 0.0069 of phosphor bronze. With a pressure of 400 pounds per square inch, and the same speed, the coefficient of friction of bronze is 0.0096 as against 0.0066 of magnalium. One of the advantages of magnalium pistons is the remarkable reduction of vibration. The melting point of magnalium is 1256 deg. Fahr. at atmospheric pressure, which is less than the temperature often attained in the cylinder. But the magnalium pistons do not get as hot as iron pistons for the reason that the thermo-conductivity of magnalium is fourteen times as great as that of iron. An engine with magnalium pistons is less liable to preignition than one with iron pistons.

Science

Searchlights for Airships are being tested in Germany. A dispatch from Berlin states that a naval airship which is to take part in the spring maneuvers will be fitted with a 40,000-candle-power searchlight capable of illuminating the surface of the sea from a height of 5,000 feet.

Dissociation of Calcium Carbide.—The increasing use of calcium carbide gives importance to all facts concerning its action under varying circumstances. M. Briner-Kurner at a recent session of the Academie des Sciences (Paris) proved that this compound was dissociated into its elements at a temperature of 900 to 1,000 deg. Cent.

Supplement to the Public Health Reports is the title of a new series of popular papers on subjects relating to health and disease, issued by the Public Health Service. Supplement No. 1, by Assistant Surgeon-General Rucker, deals with measles, which is described as a disease of much more serious import than is generally supposed.

An Interesting Subterranean River in the island of Palawan, one of the Philippines, has been explored and surveyed by two officers of the U. S. Coast and Geodetic Survey, and is described in the last annual report of that service. The river is navigable for a small boat for about 2½ miles from its mouth, the tunnel through which it passes widening in places into large chambers containing beautiful stalactites.

The Actinometer.—A useful invention in the field of technology is the actinometer, a description of which was presented to the Academie des Sciences recently by M. Daniel Berthelot. This little instrument permits the exact measurement of the ultra-violet rays of luminous bodies. By reason of the increased application of these rays, particularly for purposes of sterilization of water, etc., it is probable that this may prove to be of much practical value.

Natural Toothbrushes are described in a consular report from Santo Domingo. It appears that the stems of several shrubs and trees are used by the natives in lieu of toothbrushes, and are known as "chew sticks." Among them are the stems of the orange, the lemon, and the membrillo or quince tree, all of which have an agreeable flavor. The most commonly used, however, is a plant known as "guano," probably the same as the one called in Spanish "palma de guano." The natives use the green stem, the end of which they chew up and use as a toothbrush. Various chew sticks are similarly used elsewhere in the West Indies.

International Rubber Congress.—Preparations are being made for the International India Rubber Congress, which is to be held at Batavia, island of Java, in September of next year. A commission appointed for the purpose is now engaged in the preliminary work and is receiving the papers upon subjects connected with the rubber industry which eminent specialists are sending in. The work of the congress is divided into eight sections: 1. Botanical and zoological questions. 2. Climate and soil. 3. Culture and gathering of products. 4. Preparation and processes. 5. Methods of working plantations. 6. Artificial rubber. 7. Commerce. 8. Publications. Dr. C. J. van Hall is secretary of the congress, and the headquarters are at Buitenzorg, Java.

Death of Prof. William Hallock.—The recent death of Prof. William Hallock deprives Columbia University of its senior Professor of Physics. Prof. Hallock had an active scientific career. After graduating from Columbia University and the University of Wurzburg, he was physicist for the Geological Survey at Washington, where he also acted as Professor of Physics in the Corcoran School. From 1889 to 1892 he was Professor of Chemistry and Toxicology in the National College of Pharmacy. He also occupied for part of this time the chair of astro-physics at the Smithsonian Institution. He was connected with Columbia's Department of Physics from 1892 onward. Had he lived he would have been the official measurer of the yachts which will compete in September, 1914, for the "America" Cup. At the time of his death he was the official measurer of the New York Yacht Club.

The National Academy of Sciences will celebrate the 50th anniversary of its foundation at a meeting to be held at the National Museum, in Washington, April 22nd to 24th, inclusive. The programme will include quasi-public addresses by the president of the Academy, Ira Remsen, President Hadley, of Yale; Prof. Arthur Schuster, F.R.S.; Dr. Hale, director of Mt. Wilson Solar Observatory, Prof. Theodor Boveri, of the University of Wurzburg, and Prof. J. C. Kapteyn, of the University of Groningen. All the addresses will be in English. The National Academy, which is the premier scientific organization of this country, corresponding to the Royal Society in Great Britain, the Academie des Sciences in France, etc., was incorporated by act of Congress approved March 4th, 1863, its principal function being, as defined in the act, to furnish advice to the government "upon any subject of science or art." The initial meeting was held April 22nd, 1863, in the chapel of the University of the City of New York. It now has a membership of 120, besides 45 foreign associates.

Automobile

The Small Boy and the Horn Button.—There are few things that can be more annoying than the small boy whose eagle eye never fails to search out the button for the electric horn and whose finger unflinchingly presses it to the accompaniment of a raucous blast that startles pedestrians almost out of their wits and draws unnecessarily on the battery. In appreciation of the fact, one manufacturer of a high-priced car has hit upon the novel scheme of concealing the button beneath the leather of the upholstery. The owner knows where the button is, but no one else can even suspect its presence, for the wires leading to it also are concealed.

Motor Spirit from Living Plants.—Because the supplies of both crude oil and coal are more or less limited and are impossible of regeneration, a British chemist rises to remark, quite logically too, that the better way to solve the impending fuel problem is to obtain motor spirit from living plants. Potatoes, beets and allied vegetables, consisting largely of starch, are capable of fermentation and yield alcohol. It would seem therefore, remarked the chemist, that the soundest solution of the problem is to be sought along the lines of the production of fuel from some living plant which assimilates carbon by photosynthesis thereby avoiding the exhaustion of the source of supply.

Unusual Application of a Fan Brake.—For use in the mountainous parts of Switzerland, a car has been developed in which the usual brakes are supplemented by a large fan brake placed beneath and parallel to the chassis. When descending heavy gradients the fan is placed in motion thus causing a large displacement of air and materially retarding the car while at the same time the draft serves to prevent overheating of the rear wheel brakes and of the differential mechanism. The fan is so arranged that it can be driven through any one of the four speeds obtainable with the gear set and the blades are adjustable to provide greater or less retardation according to the steepness of the grades negotiated.

A New Road Material.—A new road material designed to stand hard usage from automobiles is being tried by a Swiss engineer, W. Erlich, and is said to consist of a mixture of broken stone about the size of a hazelnut, but not limestone, with a binding material whose composition is not divulged by the inventor. In the present process the stone is heated at first from 100 to 150 deg. Cent. and mixed at this temperature with the melted composition. When in use, the mass is remelted in order to put it on the road. A road roller heated to a rather high point is passed over the surface, the roller weighing about six tons. Reports state that very good road surface can be obtained in this way.

Influence of Engine Starters on Design.—It is interesting to note that the widespread adoption of engine-starting apparatus operating through gearing cut in the periphery of the flywheel has required the production of better flywheels. The gearing cut on cast iron flywheels scarcely can be expected to wear for any length of time and hence steel has come into more general use for the purpose. The alteration can be expected to raise the already high factor of safety for though the bursting of flywheels is a rare occurrence it is a matter of comparatively common knowledge that the rim speed of the ordinary touring car flywheel frequently exceeds the safe limit and in fast roadsters the occurrence is very common.

The Cyclecar in America.—It is doubtful if that hybrid vehicle which abroad is styled "cyclecar" for the want of a better name, ever will prove popular in America. In the first place, the American tendency is toward greater carrying capacity, whereas the cyclecar accommodates only two passengers, but what is of even greater importance, American roads are not suitable for the little vehicles. Foreign roads, as nearly every one knows, are, in the majority of cases, veritable boulevards; there are no ruts. Outside of the big cities in America, however, ruts surrounded by mud are the rule rather than the exception. And as the cyclecar can neither straddle the ruts nor run in them, either of which is necessary for some sort of comfort, it is very doubtful, to say the least, if the cyclecar ever will become popular.

Mirrors at Road Crossings.—Mirrors at road crossings for the use of warning automobiles are commencing to be used in England, it is stated, and the results are very good. They are being put in places where the crossings are specially dangerous and the use of large mirrors allows the driver to see the reflection of cars which are coming in other directions. The method will probably be extended in the future, as it is likely to avoid many accidents and will be well worth the small cost of putting in. Another use for mirrors is upon heavy power wagons, where the driver cannot hear the signals of automobiles back of him so as to have him take the right-hand side of the road to allow them to pass, for the noise of the power wagon often prevents the horn from being heard. It is proposed to fit the power wagons with small mirrors showing the back of the road, but were this to be made obligatory, the mirrors might be imposed upon the usual automobile cars as well, and this would give rise to some objections from their owners.

The Screw Spike Versus the Cut Spike

The Tie and Rail Fastening in Their Relation to Safety of Travel

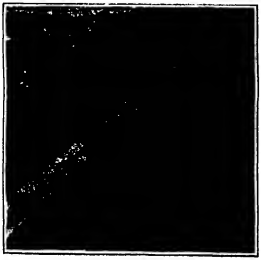
ALTHOUGH the typical American railroad track when the ties and fastenings are new and the ballast is of good quality, proper depth and well tamped, is an excellent construction for its purpose it is liable to very rapid deterioration and unless the inspection is constant and careful it very quickly begins to show signs of wear and if neglected may rapidly degenerate into conditions dangerous to the traffic.

The present article has to do with the tie and rail fastening and particularly with the latter. These have not kept pace with the great increase in the weight of trains and speed at which they are run. Except for the gradual introduction of tie plates placed between the base of the rail and the wooden tie in order to distribute the load and prevent the ties from being crushed down, the average American track to-day is the same in general type as it was fifty years ago. Its most glaring defect is the cut spike, which is nothing more nor less than a magnified nail—and it does not take the expert mind of the engineer to understand that nailing the rails which carry the heavy traffic of to-day down to a wooden tie is a practice that ought to have become obsolete many a decade ago. The cut spike is bad from whatever point we look at it. When it is driven down into the tie by the blows of a heavy sledge it does not cut a clean snugly fitting hole but instead it tears its way through the fiber producing the ragged hole, shown in one of the accompanying engravings. The result is bad in two ways. First the holding friction between the spike and the badly torn fibers of the tie is comparatively poor; secondly the jagged hole thus opened into the tie favors the entrance of water and tends to set up a rotting action, which soon robs the tie of its already limited holding power.

In cases where the rail rests immediately upon the wooden tie, and to a less degree where tie-plates are interposed the heavy loads of modern traffic tend to work the rail plate or the tie plate down into the tie and away from the head of the spike. Moreover the general elasticity of the rail, ties and ballast causes the wheels of the train to produce a wave like action which gives to the rail at any particular point a powerful vertical movement. The rail is first depressed and then by its own elasticity or by the wave like action returns to or above its original position, pulling the spikes with it, and leaving them in time with the head from one to as much as two inches above the base of the rail. This condition in one of its worst forms is shown in one of our smaller illustrations. Some of our more progressive railways have recently begun to adapt the screw fastening which has been common practice on European railroads for a long period of years. In some cases the screw spike is screwed down into place without boring of any preliminary hole, but the best practice is to bore a hole smaller than the spike, and then screw the latter firmly down into position with its head bearing snugly on the base of the rail. We present an illustration of a screw fastening which is being used on the Harriman roads with great success, in which the holding power of the spikes is greatly increased by first screwing down into the tie a helical steel lining, of the same pitch as the threads of the spike, which are engaged by the threads when the spike is in place. This device provides a greatly enlarged area of resistance against shearing, and it is particularly valuable when the softer woods are used.

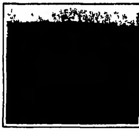
The great superiority of the screw over the cut spike was demonstrated by some tests made at Columbia University by Prof. Ira H. Woolson. In these pulling tests, it was demonstrated that the maximum resistance of cut spikes driven, without boring, into seasoned oak ties was 5,160 pounds and the maximum resistance of screw spikes was 13,580 pounds. The tests of Hardy Catalpa wood shows the maximum resistance of cut spike for twelve tests was 5,000 pounds and for fourteen tests of screw spikes the maximum was 9,440 pounds. Four and five tests respectively of seasoned chestnut gave 3,220 pounds resistance for cut spikes and 11,150 pounds for screw spikes. Forty tests of seasoned loblolly pine gave a maximum resistance for cut spikes of 6,250 pounds and for screw spikes, 13,710 pounds.

The superior results with screw spikes as thus obtained in the laboratory have been confirmed in actual service in the tracks.



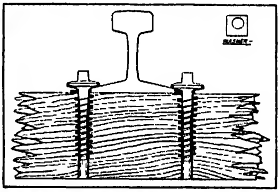
These spikes have been partially drawn by vertical working of the rail.

Crushed and splintered ties, found by Interstate Commerce Commission at scene of a derailment.

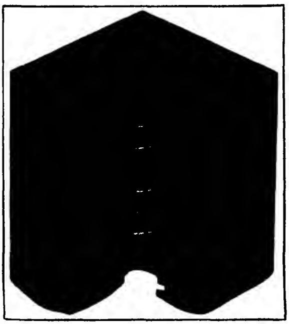


"Shims" between rail and tie destroy holding power of spikes.

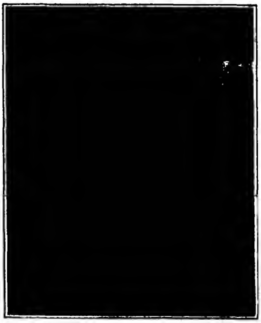
How rail spikes are drawn by the vertical movements of rail.



Section through a portion of a railroad tie showing the bored hole, helical lining and screw spikes in place.



Section of tie, showing helical lining as used with screw spikes on the Harriman lines.



Section showing the brutal tearing of tie fiber by driving cut spike.

The Color of Cocoons

THE color of the cocoon produced by certain Lepidoptera is the object of researches made by the German scientist, Dewitz. In the case of the *Hasiocampa quercus*, he observes in the case of a caterpillar kept in a tin box, that about 8 or 9 o'clock A. M. it prepares a gray cocoon formed of silk and a certain number of hairs, and it is only about 2 o'clock P. M. that it commences to saturate the cocoon with a creamy liquid which solidifies and renders the cocoon hard and durable. Making a small opening, he is able to see the caterpillar spreading the liquid on the inside with its mouth, so as to be absorbed throughout the whole mass. The finished cocoon is of a light gray hue, but if this is now taken off, the caterpillar commences to make a second one, in which the silk is entirely white, and this is due to the fact that the provision of liquid has now been exhausted, so that no more can be put on and the cocoon remains in its original state. It should also be remarked that in the case of the first cocoon, after saturating it with the liquid the caterpillar then lines it with a white silk which remains in the natural state in all cases. Such cocoons when placed in water become black, and the water takes a brown hue. He also notices that the moisture of the air causes color changes, and the cocoon is almost black in damp air, but remains a light gray in dry air.

How to Clean Brass

TO clean brass furnishings or to remove fly spots or tarnish from them they should be boiled for a few minutes in a solution of one ounce of alum to every pint of water. After boiling they should be polished by some brass polish or just a dry cloth. This will remove tarnish from all crevices where other means fail.

Lifeboats Which Can Be Launched on Either Beam.

UNTIL the time arrives when ocean-going steamships are so fully protected against sinking that every ship can act as its own lifeboat, it will be necessary to stow sufficient lifeboats to take care of every soul on board. As compared with present conditions, this involves carrying twice and in some cases three times as many lifeboats as are now carried on some ships. Where such an increase is made, especially in the largest vessels, the problem of stowage and the getting of the boats to the side of the ship becomes a very difficult one.

At the time of the loss of the "Titanic," the SCIENTIFIC AMERICAN, in its issue of April 27th, 1912, published a study of this problem in connection with the ill fated ship, in which it was shown that by stowing the lifeboats athwartship and dispensing with some of the deck structures, it was possible to provide for fifty-six lifeboats instead of the twenty that the ship carried. It was suggested that in order to be able to launch the boats on either side of the ship, that is to say, to which ever side she was listed, the boats should be mounted in boat skids or cradles, running in grooves sunk in the deck of the ship.

We have been much interested to learn that the large Flushing Royal Mail steamers of 8,000 tons, owned by the Netherland State Railways and running on night service from Folkestone to Flushing, have for the past five years been making use of this method of carrying and handling lifeboats, and we present the accompanying illustrations, showing how the boats are stowed and launched. The ships of this company make it a point to provide sufficient lifeboats to accommodate every person on board. This calls for a larger number of lifeboats than it would be possible to carry conveniently in davits along the side of the ship and consequently, some of the boats are carried amidships in the manner shown in the accompanying engraving, which represents one of the deckhouses, with four boats mounted above the level of its roof.

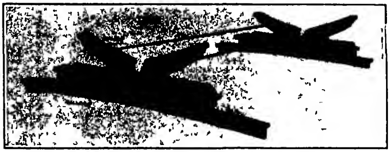
The two outer boats at the side of the vessel are mounted adjacent to the davits, the other two boats are mounted on movable boat skids, which are arranged to travel on a curved rail which spans the deckhouse from side to side of the ship.

The V shaped boat chocks are mounted pivotally on the center of the movable skids, the top edges of the two plates which form the sides of the skid are arranged to receive eyebolts, which are placed in such position that the boat at whatever part of the rail it may be stowed and made fast will rest in a vertical position.

It will be evident from a study of this arrangement that when the center boats are to be launched, all that is necessary is to undo the lashings of the skids, make fast the davit tackles, and slide the boat to port or starboard, where it is hoisted, swung outboard, and lowered. The arrangement permits all four boats to be lowered on whichever side of the ship is advisable, this, of course, being in every case the side toward which she is listed.

It should be noted that any obstacles on deck, such as hatchways, are easily overcome by building the rails above the same. In practice it takes the crew fifteen minutes to transfer half the boats from one side to the other, and to lower all the boats into the water over one side. The device was worked out by one of the company's officers and it was awarded a gold medal as an improved life-saving device by the Exhibition of Safety which was held at the Hague in 1908.


Boats of the Flushing Royal Mail steamers as arranged for launching on either side of ship.


Details of the rails and boat skids.

Echoes of the Andrée Expedition

BUOY NO. 10 of Andrée's ill-fated balloon expedition in the Arctic was found last September floating off Prince Charles Foreland, west of Spitsbergen. Discussing this event in the Swedish journal *Ymer*, in connection with the previous discovery of buoys Nos. 3 and 8 on the southwest coast of Iceland, Dr. Nathorst concludes, in view of the known course of the currents, that all three were thrown over somewhere to the southwest of Franz Josef Land. From all the remains, it seems certain that the course of the balloon was first northeast; then, after a westward turn, easterly. The final catastrophe seems to have occurred between Franz Josef Land and Nova Zembla.

Making the Aeroplane Safe by the Gyroscopic Stabilizer

By Robert G. Skerrett

IT is commonly recognized to-day among aviators and the builders of flying machines, that stability is the quality most to be emphasized in order to insure greater advance and wider adaptation of the aeroplane. This stability must be either inherent or so responsive to automatic control that the pilot shall be subjected to a reasonable minimum of executive nervous stresses.

As we know, Monsieur Gustave Eiffel and his distinguished collaborator, Engineer Drzewiecki have produced the "aerostable," a combination of tandem wings which, through their measure of opposite impulses, tend to establish automatically a resultant stability in the machine which is mutually supported by them. This, in brief, constitutes the element of inherent stability by which an aeroplane of that design is steadier in flight and not so apt to tip vertically, i. e., fore and aft, because of gusty conditions of the wind prevailing at the time.

But the aerostable is only a partway solution of the problem of longitudinal stability and has nothing to do with the lateral aspect of the question which is undoubtedly the more difficult to meet. The most successful efforts to deal with these two departments of aeroplane stability have been those of Mr. Elmer A. Sperry, who has been experimenting in conjunction with Curtiss machines for more than a year. Recent trials at the Curtiss camp at San Diego, California, have demonstrated the correctness and the efficiency of Mr. Sperry's gyroscopic stabilizer.

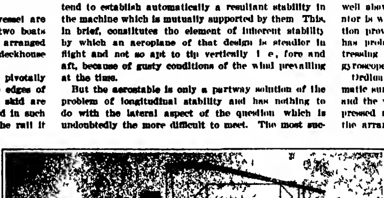


Diagram of the Sperry gyroscopic aeroplane stabilizer

The gyroscope as a stabilizer for aeroplanes is not, in itself, essentially new, but the manner in which Mr. Sperry employs its corrective agency is a novel one. In the present apparatus this measure of safety control is not entirely the result of the functioning of gyroscopes, and this departure is one of the ingenious features of the installation. He employs a tempering mechanism which overcomes one of the serious defects which characterized earlier stabilizers using the gyroscope, pendulum, or other inspiring medium tending to maintain horizontality. We shall appreciate the value of this modification presently.

In our illustration of the vital mechanisms of a hydro-aeroplane, the rectangular disk is the exposed surface of an anemometer. Its duty is threefold. First, it furnishes a visible record at every instance of the speed of the aeroplane, it catches the machine when rising too slowly and starts the flyer upon a life-saving volplane before there is danger of its sliding backward and it also serves to regulate the angle of the various maneuvering planes, so that the amplitude of their steering effect will just suit the speed of flight at any moment.

When climbing the aviator ordinarily knows next to nothing about the actual rate of his progress. The nose of the aeroplane points upward and his engines may be working smoothly and yet the very angle of his rise may cause the aeroplane to slow down dangerously close to the critical speed at which the air fails to sustain the machine. Before he knows it the flyer starts slipping backward and well nigh instantly the aeroplane is falling uncontrollably earthward tail first. Let us see how the anemometer comes to the rescue.

When the wind pressure on the little disk registers within a few miles of the speed of minimum buoyancy the anemometer brings into play a small electrical apparatus termed a servo-motor which operates a shaft leading to the lever in the system of longitudinal control. This shaft does two things: first, it shifts the fulcrum so that the pilot cannot operate the lever and then it functions the lever itself through the medium of compressed air in such a manner that the aeroplane is made to turn its nose earthward a number of degrees, thus starting the machine automatically upon a gliding descent. This impulse is sufficient to bring the velocity of flight well above the critical point and in this way the aviator is warned of the danger that was near and correction provided simultaneously. Ignorance of this peril has probably been responsible for a number of distressing accidents. In this particular operation the gyroscope is not an essential associate.

Ordinarily however, the gyroscopes exercise automatic surveillance over stability both in the horizontal and the vertical planes, by regulating the flow of compressed air to the operative cylinders. In principle the arrangement is rather simple. The motive cylinders are attached to the same cranks or levers that can be worked by the pilot's hands or the lateral swing of his body against the yoke attached to the back of his seat. The hand wheel in front of him functions the vertical movement of the nose of the machine while the lateral throw of his body corrects or guides the horizontal tipping. Both of these operations are subject to his will so long as he presses an attachment on the steering wheel and he can maneuver the machine quite independently of this manner despite the action of the stabilizing gyroscopes. But when he does not will to supersede the guardianship of the gyroscopes, then they take over the command of all lateral and vertical movements on the part of the aeroplane and experience has amply demonstrated that these little spinning wheels are far more alert than the most skilful of aviators.

The way the gyroscopes work is as follows: when a disturbing impulse in the form of a wind gust hits any part of the system of guiding planes the gyroscopes whose duty is to provide a remedy move in opposition and in thus swinging they actuate a wonderfully delicate balanced valve in the air supply line and motive energy is accordingly fed to the proper cylinder, the piston rod of which pulls or pushes the required lever to which the wires are attached that run either to the ailerons or wing tips or to the plane at the end of the tail. But these gyroscopes have no quantitative discrimination and would cause the planes to move through a given angle, no matter whether the flying machine were going fast or slow. In other words, if travelling at a high velocity, this effort to stabilize would probably produce violent motions that might throw the

pilot out of his seat and do harm when really intended to help. It is here that the anemometer comes again into play. By continually shifting the fulcrum of the intermediate cranks or levers it qualifies the measure of the angular movement, either of the ailerons or the elevator at the tail, and thus an easy steering or corrective action follows, the wind pressure on the face of the sentinel anemometer prescribing the amplitude of the movements of the necessary planes.

The electrical impulse for the spinning gyros is obtained from a little dynamo driven by a belt from the forward end of the crank shaft. This motor weighs only a few pounds, and should the engine stop, there is held in reserve sufficient power for operative purposes, for a short while in a storage battery. This energy would meet all requirements incident to a descent and is automatically thrown into service when the engines halt. The manner in which this dynamo is constructed makes it possible to generate both direct and alternating current, and the latter is available for wireless telegraphy without the weight incidental to a separate installation for that particular service. Compressed air is cleverly obtained by a small apparatus attached to the head of one of the cylinders. It catches the impulse of an explosion at the instant following ignition, and a nicely adjusted check valve prevents any of the explosive mixture reaching the air tank. In this manner the reservoir is kept charged at the desired pressure and a sufficient reserve is maintained, so as to provide motive energy for the stabilizing equipment for a reasonable time after the engines cease to work.

The previous difficulties with stabilizers has been that they dangerously hampered the independence of the pilot. Mr. Sperry, however, leaves the airman free to exercise control or to turn the task of stabilizing over to the apparatus in the interim, the aviator being superseded in command only when through ignorance or inattention, danger is near. At San Diego, Mr. Sperry's son and some of the Curtiss pilots have deliberately gone out over the water and tried to upset the stabilized machine and in every case the apparatus has responded to the demand and functioned effectively. This not only means a material gain in military value, but it bears importantly upon the future use of the flying machine either for sport or commercial service of one sort or another.

Aeroplane Accidents

SINCE the last fatal aeroplane accident in our Government service in which Lieut. J. D. Park lost his life, near Los Angeles, Cal., on the 9th of May, attention has again been invited to the large number of casualties which have followed aviation in our military service.

Some rather startling statements of percentages have followed, but before relying too much upon these it may be well to note that our misfortune in having a number of casualties occurring closely together, combined with the very small number of aviators which we have in our service would greatly exaggerate our situation in this respect. A far more useful comparison might be made when we consider the average number of hours in the air and miles covered per aviator. It is admitted that the percentage of casualties in our service is high, since six of our officers have lost their lives, beginning with the sacrifice of Lieut. Thomas E. Selfridge in the preliminary trials of our first military aeroplane at Fort Myer, Va., in the autumn of 1908. When we examine our records in connection with the only other nation from which exact data are available (England), we find that our aviators average nearly twice the number of hours in the air and miles covered per aviator.

The data from France include pilots of all kinds, and consequently do not furnish a basis for estimate. If we consider simply percentage of losses, Italy is ahead of us in the mournful statistics, while England is very close. There is one thing which an examination of the statistics presents, and that is the greater percentage of casualties occur in the first few flying months after which there is a marked falling off. This fact alone gives France a great relative advantage since her officers have been under training for periods that average much longer than our own. Due to the exigencies of the service, very few of our officers have been available for long periods of training in aviation.

When it is considered that the United States has been able to furnish so few of her officers for this service and that such modest equipment has been provided the records of aviation in our service are causes for congratulation, rather than commiseration. Unfortunately, casualties are given much more prominent places in our publications than the praiseworthy achievements.

If we regard the latter, and recognize that aeronautics has risen to an important place among the great war establishments of all military nations, it will no doubt be admitted that it is worth the cost, regrettable as it may be.

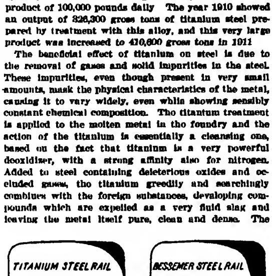
Ferro-titanium Alloy in the Manufacture of Iron and Steel

By Charles V. Slocum

THE physical characteristics and the uniformity of iron and steel have been remarkably improved by the use of titanium in the foundry. The titanium treatment tones up the endurance of steel against mechanical shock, friction and abrasion in railway rails, chilled car wheels, chilled rolls and the like, and enables high speed metal cutting tools to hold up structural steel.

The use of titanium alloy in iron and steel is of comparatively recent date. The successful manufacture of this alloy was achieved by Augusta J. Rossi, using the electric furnace (which has so many metallurgical feats to its credit) after many years of experimentation with other furnaces. Since being established on a sound basis by the aid of the electric furnace, the manufacture of titanium alloy has gone ahead by leaps and bounds, a single factory now having a product of 100,000 pounds daily. The year 1910 showed an output of 326,300 gross tons of titanium steel prepared by treatment with this alloy, and this very large product was increased to 410,600 gross tons in 1911.

The beneficial effect of titanium on steel is due to the removal of gases and solid impurities in the steel. These impurities, even though present in very small amounts, mask the physical characteristics of the metal, causing it to vary widely, even while showing sensibly constant chemical composition. The titanium treatment is applied to the molten metal in the foundry and the action of the titanium is essentially a cleansing one, based on the fact that titanium is a very powerful deoxidizer, with a strong affinity also for nitrogen. Added to steel containing deleterious oxides and occluded gases, the titanium greedily and searchingly combines with the foreign substances, developing compounds which are expelled as a very fluid slag and leaving the metal itself pure, clean and dense. The



Comparative wear in equal time of Bessemer and titanium rails.

alloy may be added in the ladle preferably shoveled directly into the stream running from the iron cupola or steel furnace into the ladle, so that the lumps of alloy (resembling so much pig iron) are thoroughly churned up in the molten metal. It is important to mix the alloy in thoroughly as it is much lighter than the fluid steel. After standing for a few minutes the ladle full of molten metal is poured into the ingot molds or into castings.

In railway rails alone the effect of titanium has been most striking because of the urgent need of better metal to support the great weight, high speeds and generally severe service in modern railway traffic. The accompanying illustration shows at a glance the beneficial effect in the lessening of wear on the head of the rail. The drawings are cross sections of two rails weighing 100 pounds to the yard, laid on the high or outer side of a railroad curve subject to continuous heavy traffic, and show the wear on the rails after a few months' service. The first drawing shows the original outline and the outline after the stated wear on a rail from titanium treated steel, and the second drawing shows the original and worn outline on a plain Bessemer steel rail. The treated rail in this instance has a considerably larger carbon content, but this increase is not essential to the success of titanium, although it should be noted that the titanium treatment so fluidizes the steel as to permit using comparatively high carbon that would, without the titanium treatment, cause brittleness in the steel.

What Are the Ten Greatest Inventions of Our Time, and Why?

A Prize Article Contest Open to All Scientific American Readers

THE November Magazine Number of the SCIENTIFIC AMERICAN is to be devoted in part to a review of the great inventions of our time. Because a large number of SCIENTIFIC AMERICAN readers are either inventors or users of inventions, it seems to the Editors that their judgment of the inventions produced in our time which deserve to be called the greatest, their appraisal of the relative importance of the paramount technical achievements of our day, would be of peculiar value and interest. Therefore, it has been decided to leave the entire subject to them.

The publishers of the SCIENTIFIC AMERICAN offer three prizes of $150, $100 and $50, respectively, for the three best articles on the topic, "What Are the Ten Greatest Inventions of Our Time, and Why?"

Contestants for the prize must observe the following rules:

1. Each article must discuss and answer the following three questions:

a. What, in your estimation, are the ten greatest inventions produced within the last twenty five years?

b. What are your reasons for this selection? Justify your selection in each case.

c. To what person or persons is the greatest credit due in the developing and perfecting of each invention which you have selected?

2. The entire subject must be covered in a typewritten article not exceeding 2,500 words in length, and must be treated as simply, lucidly and non-technically as possible.

3. In deciding what are the greatest inventions of our time, the contestants are limited to machines, devices and discoveries commercially introduced in the last twenty five years.

4. Since the SCIENTIFIC AMERICAN is "the weekly journal of practical information," and its readers practical business men and inventors, the articles submitted should deal only with *patentable* inventions and discoveries.

5. In order to guide the contestant in deciding what is a great pioneer invention of our time it is suggested that practical success and general usefulness to mankind be used as a test. A modern discovery may have been suggested long ago and its underlying theory even worked out mathematically, as in the case of wireless telegraphy, but nevertheless it falls within "our time," if it has been made generally accessible and useful within the last twenty five years. But commercial success should not be the sole criterion. The flying machine has not yet added millions to the national wealth, but, for all that, it is a great invention of our time. More improvements on well known and successful devices are not to be numbered among the great inventions of our time.

6. Contestants must not disclose their identity. Each article must be signed with an assumed name and must be accompanied with a sealed envelope, on which the assumed-name is written, and in which the real name and address of the author is contained.

7. Contestants must address their articles, accompanied by the envelopes containing their real names, to "The Invention Contest Editor of the SCIENTIFIC AMERICAN, 361 Broadway, New York city."

8. The articles will be passed upon by a Board of Judges, whose names will be announced in a future issue of the SCIENTIFIC AMERICAN.

9. The Board of Judges will receive only the articles submitted, the envelopes containing the true names and addresses of the authors will remain in the possession of the Editors of the SCIENTIFIC AMERICAN. When the judges have made their decision, the Editors will open the envelopes of the winning contestants and notify them of their success.

10. The decision of the judges will be announced in the SCIENTIFIC AMERICAN of November 1st, 1913. The prize-winning articles will be published in the order of merit in consecutive issues of the SCIENTIFIC AMERICAN, beginning with the issue of November 1st, 1913.

11. The Editors of the SCIENTIFIC AMERICAN reserve the right to publish in the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT articles which have not been awarded prizes, but which are deemed worthy of honorable mention.

12. While contestants are not required to supply pictures with their articles, illustrations will be welcomed. If drawings are submitted, they need not be elaborate, the staff artists of the SCIENTIFIC AMERICAN will work them up for reproduction, provided the material supplied is intelligible. Do not send pictures torn from books and periodicals, they cannot always be reproduced satisfactorily, and their unauthorized reproduction may constitute a copyright infringement. If photographs marked "copyright" are sent, they should be accompanied with the copyright owner's written permission for their reproduction.

13. Members of the staff of Munn & Company, Incorporated, publishers of the SCIENTIFIC AMERICAN, and of Munn & Company, solicitors of patents, are excluded from the contest.

14. All articles will be received up to 5 P. M., September 1st, 1913.

Another Aeroplane Patent.—An aeroplane shown in a patent, No. 1,056,944, to John Thomas Simpson of Newark, N. J., comprises a frame for the aeroplane, together with a sustaining plane and a balancing plane, both planes being separately connected to the frame and having mechanism by which they may be moved from side to side to obtain stability.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Bow Rudder

To the Editor of the SCIENTIFIC AMERICAN

Your issue of March 15th is just received here to-day, and shows a desultory interest in the bow rudder I spent last summer on the Lake of Thun, and noticed that the fleet of seven steamers were all fitted with bow rudders. The wheel house contained two wheels, mounted one immediately abaft the other, their relative positions, fore and aft, denoting which rudder they controlled These ships were legitimate river or lake steamers, not double-ended ferryboats, and were steered by the after rudder, on the lake. At Interlaken is a long canal into which the steamers ran forward. They were always backed down to the lake, and during that operation were steered by the forward rudder, which temporarily represented the stern. At Thun, where the lake empties and where the current is strong, the steamers are turned out in the lake and entered stern first, again using the bow rudder At Thun there are two landings, in making one of which both rudders are used, a quartermaster for either wheel This operation seemed to give a decided sidewise or broadside motion, which may have been the reason for it, the current past the landing stage being rapid

Paris, France WILLIAM H BRADFORD.

Automatic Lighting of Light Buoys by Means of Selenium

To the Editor of the SCIENTIFIC AMERICAN

An article in your issue of March 8th, entitled "Lighting Light Buoys by Wireless," is read with great interest, and the new application of the familiar "Wireless distant control" appears to be an improvement in this case over the old system of shore control of lights on buoys.

In practice, however, it will doubtless be found that additional complication is involved and a certain degree of reliability sacrificed, also the installment of wireless tuning and receptive devices in buoys will be an additional expense which will not meet with favor

If it is the object to avoid the old system of shore supply and control to light buoys and further locate the source of power in the buoy itself and do away with the cable, the writer suggests that the buoy contain the necessary batteries, also a selenium cell and relay

By this method we do away with not only the cable, but also with the proposed wireless apparatus, and have a purely automatic signal which will need occasional renewals and inspection.

It seems hardly possible that this application of the "selenium cell" is new, but since it appears a great simplification of the newly proposed German system, and since no mention of it is found, this idea is respectfully submitted and may be taken for what it is worth in the estimation of those familiar with the light-buoy problems.

The above system is, of course, applicable to many modification. for example, control by means of a ship or shore searchlight. A KELLOGG SLOAN

Brooklyn, N Y

Undamped vs. Damped Oscillations

To the Editor of the SCIENTIFIC AMERICAN

My attention has been called to certain publications that have been made in your Journal of late in which the statement has been made that the result of the Navy test on radio-telegraphy, as conducted between the Arlington station and the cruiser "Salem," had shown very conclusively a marked superiority, in long-distance operation, of the undamped oscillations over the damped oscillations or, as it has generally been spoken of in the press in discussing these tests, of the oscillations from an arc generator as contrasted with those of a spark generator. While it is perfectly true that superior results, for given amounts of energy, were secured with the undamped oscillations, over those secured with the damped oscillations, the real cause of this superiority has not, I believe, as yet been noted in any of the press statements. I therefore wish to call your attention to the fact that this superiority was shown when using the Fessenden receiving apparatus supplied to the cruiser "Salem" as part of its equipment in connection with the spark equipment supplied by the National Electric Signaling Company It was a fact well recognized by the engineers of the company that the heterodyne would work to its best advantage with undamped oscillations, it having been invented and developed for that specific purpose and later adapted to the spark type as well, and it was also well known by them that it supplied the best known receiving mechanism for undamped oscillations. This superiority was so great that after the first few days all other forms of receiving apparatus were abandoned by the Navy officials in their test with the undamped oscillations. The heterodyne receiving apparatus operates upon the principle of "beats" in which interference beats of adjustable frequency are produced between the incoming oscillations and those produced in a local circuit. It is thus possible, in view of the action being a resultant of two forces, one from the sending station, and one produced locally, to considerably increase the energy available for operating indicating mechanism for receiving the signals. It is also possible by adjustments at the local circuit to secure a pure flute-like musical tone of any desired pitch and thus allow the operator to select what best suits his ear This note is written simply in the interest of accuracy in order that readers interested in this line of work may be made aware of the real cause of the superiority shown by the Government test

Pittsburgh, Pa. SAMUEL M KINTNER.

Submarine Mountains

To the Editor of the SCIENTIFIC AMERICAN

It may be of interest to some of the readers of the SCIENTIFIC AMERICAN to know that there are mountains and volcanoes under the sea, the same as on the surface, one of which I will describe While acting as second officer of the U S. cable ship "Liscum," stationed at Manila, P I, we were ordered to proceed to Malabang, and run a line of soundings from that place to Zamboanga. These are two important military settlements on the island of Mindanao, and it was the intention of the department to run a new cable between these two places After leaving Malabang we steamed slowly toward Zamboanga, taking soundings every thirty minutes, keeping a record of same. The water gradually deepened from the time we left Malabang until we were off Lutangang Point, where we got 800 fathoms, when the man in the crow's nest sang out "Shoal ahead" We immediately took bearings and fixed the ship s position on the chart, but did not see anything marked on the chart that resembled a shoal or anything like it, so we slowed down and proceeded, stationing a man at the lead, and when directly over the shoal spot we got six fathoms up and down from the bridge. It appeared to be a circular spot about 100 feet in diameter and of coral formation We only got one cast of the lead when we were in deep water again, so we came to the conclusion that we had run over either a submarine volcano or mountain for nothing short of a good-sized mountain or some other kind of submarine formation could give such soundings in two or three feet, as sounding a few minutes before we arrived over the shoal spot gave 800 fathoms taken with the patent sounding machine

Cape May Point, N J ALBERT E REDIFER

Ignition Devices

To the Editor of the SCIENTIFIC AMERICAN

The writer, a reader of the SCIENTIFIC AMERICAN for many years, has noted with interest the article, 'Small Internal Combustion Engines on Land and Water" in the April 5th number

The fifth paragraph in this article would lead one to believe that the high-tension magneto was the best ignition for stationary and marine engines and offered a complete solution for their ignition troubles

You may be interested in knowing that from careful investigation, we find only about 40 per cent of the stationary and marine engines now being made are equipped with jump spark (high-tension) ignition, this including both battery and magneto If engines already in service are counted, the make and break engines outnumber the jump spark three to one

As your correspondent is no doubt aware, the principal reason for the adoption of the high-tension magneto on the automobile was the difficulty in timing four make-and-break igniters to operate in correct relation with each other and a common source of current This objection does not hold good with a single-cylinder engine, which represents by far the majority of power units in the stationary and marine field

As to the comparative efficiency, from a purely igniting standpoint, there can be no question but that the make-and-break is far the superior The spark is more dynamic in character, and is hotter The make-and-break system is most successfully used in connection with low-grade oils and gas-producer units, where the ordinary high-tension, jump-spark plugs rapidly short circuit by deposits of soot.

The most simple ignition device imaginable is a low-tension engine-timed alternating-current magneto This machine has no commutator and brushes, no timer contacts like the high-tension magneto, it has a single winding on the armature, requires no coil, switch or other auxiliary apparatus, is built into the engine, thereby forming a part of same, and eliminates entirely the complications of battery or high-tension magneto ignition, and at the same time furnishes a vigorous spark suitable for igniting all kinds of low-grade fuels.

We can cite to you several instances where, since the advent of this type of magneto, manufacturers have abandoned the jump-spark system and gone back to the make-and-break. This is especially true on single-cylinder engines where the high-tension system has absolutely no advantage and, in fact, has several drawbacks Of course, where there are a number of cylinders, the cost of the make-and-break igniter mechanism would be greater than the jump-spark magneto and plugs.

We believe after exhaustive investigation that it is the source of ignition that will eliminate the ignition problem in stationary and marine units. The high-tension jump spark has its field, but this field is certainly not in connection with small internal combustion engines, for many reasons. H R. VAN DEVENTER.

Sumter, S. C

Straightening the Mississippi River

To the Editor of the SCIENTIFIC AMERICAN

Notwithstanding all that has been written by correspondents in the SCIENTIFIC AMERICAN opposing the policy of straightening the course of the Mississippi River, I feel confident that this method, together with a system of levees as advocated by the SCIENTIFIC AMERICAN, is the most practical of all the suggestions yet made

The actual distance from Cairo to the Gulf is about one half the present length of the channel from Cairo to the mouth of the river If this channel should be straightened to two thirds its present length, the pitch per mile and the consequent flow in miles per hour would be increased one half The product of these factors gives us a theoretical capacity of discharge to the Gulf equal to two and one quarter times that at present I am fully aware of the fact that theory and actual practice are often separated by real, or seemingly impractical, barriers Great obstacles are, however, often overcome by Nature herself when directed by human skill, which in the present case may doubtless be applied so as to make the force of the current do the bulk of earth removal For instance, a loop of the river may be cut out by digging a deep, straight and narrow channel through the alluvial soil to start the current, and if necessary may be further aided by building booms, coffer dams, etc.

This straightening of the course of the flood channel would surely be a long, gradual, and expensive engineering feat but it would accomplish results for the lower Mississippi region far more effective than the reservoir schemes

However, I believe that much of the real lowland should be allowed to be overflowed at each flood season

Scranton, Pa CHARLES H FOGGETT

Control of the Mississippi

To the Editor of the SCIENTIFIC AMERICAN

I have read with considerable interest the letters that have been sent in on the flood problem As the editor of the *Boot and Shoe Recorder* remarked in the May 3rd number, I am an amateur, but I hope I can see a little farther than some

I will agree with Danville, Ind , on the reservoir proposition Suppose there were a half dozen reservoirs in the Mississippi valley, where would the surplus water go in a flood like the one we had in this country in March? It would be all right if it rained only a few miles on each side of the river, then reservoirs would hold the dampness, but when the Mississippi drains one half—or nearly so—of the United States it is quite different White Plains, N Y, thinks that a dam every few miles on the Mississippi would cost only a few dollars. The channel would be in a fine shape with his dams The old river would be one long string of rapids, which would benefit no one And again, suppose the dams were there, would that keep the flood in the channel? No!

Littleton, Del , says it would be a snap to straighten the Mississippi Yes, it could be done, but what good would it do? Say it is as straight as a string from St. Paul to the Gulf and wide and deep enough to carry the highest floods. How long would it stay straight? Until the first high flood came, or may be a couple of years, which I doubt Why? Because on one side the bank would cave or a pocket would form That would have a tendency to form a cross current, and slamming up against the other bank, out would go another pocket So in a few years it would be as crooked, if not more so, than it is now We will suppose again that the whole river flowed in a channel of rock. Littleton, Del , would be in the swim Who ever heard of a "runway" for a flood? The Secretary of the Interior must have been thinking of muskrats or beavers, as these animals use "runways" Plattsburg Barracks, N Y , should know that there is a slight difference between the Kaw River at Kansas City and the Mississippi He asks if the channels of certain rivers have not been choked? The Kaw might have choked in 1904, but that is ancient history He should keep up with the times Everyone knows, or should know, that bridge abutments retard a river ever so little Bridges go out only when houses and buildings form a dam, and then something *has* to go It seems to me that dykes and revetting would be the best. It doesn't look fair to tax the land that abuts a river and not the plantation or farm back of it. If I lived five or more miles from a dyke I should be taxed to keep that dyke up Then they would be built larger and better I have no fool suggestions to give, as there have been too many of that kind sent in

Thornville, Ohio. JAKE HITE

Fig 1.—The kite reel and the camera attached to the wire.

Fig. 2.—View of Delmar, Iowa, from an elevation of 700 feet.

Photography from a Kite

By A C Gault

WITH the idea of awakening an interest in the fascinating pastime of aerial photography the following experiences of the writer are recounted. It is hoped that they may prove of value as well to others who have tried to take photographs from the bird's point of view.

The kite which the writer employed is similar to those used by the United States Weather Bureau, known as their "moderate wind" type. It is illustrated in the picture showing the kite reel and other apparatus mounted on a rude home-made cart ready for transportation to the field. The kite contains 68 square feet of supporting surface, but I find it necessary to use a tail to secure sufficient stability to prevent blurring the picture. It is flown by means of a piano wire, No. 12, 0.029 inch in diameter. There is about three quarters of a mile of wire in the reel, but the kite would carry out more in a strong wind.

The camera is a specially constructed home-made affair weighing with a double plate holder, about two pounds, and taking a 5 by 7 picture. To prevent excessive oscillation it is secured to the kite string or wire six hundred feet or more from the kite. Methods of connecting it to the wire are shown in Figs. 1 and 4. That shown in Fig. 4 is preferred. A description of it is hardly necessary as it can readily be made out from the photograph. It will be evident that the bracket is universal, permitting the camera to be pointed in any desired direction. The photograph, Fig. 2, shows the town of Delmar, Iowa, as viewed from a height of about seven hundred feet. In making this exposure the shutter was released by means of a piece of burning punk placed in the aluminium box shown in Figs. 1 and 4, under the bellows of the camera near the forward end. This box was used to prevent the wind from extinguishing the fire. The length of time elapsing before an exposure was governed by the length of punk employed, which burned through a thread, thereby releasing a rubber band that sprang the shutter. In taking the photograph, Fig. 5, a clock mechanism was substituted for the punk and an improved carriage was employed for the camera. By this means the exposure could be made at any desired time and the camera could be pointed in any desired direction by a few adjustments which could be made in a fraction of the time required by the other method. The details of this mechanism and the bracket are not disclosed in this article, for the reason that they have not as yet been protected by patent. The photograph shows a stone quarry. The garage at the lower left hand corner looks rather flat. Note the creek in the upper part of the picture and the bridge at the extreme left, also the patches of snow, one at the foot of the hill and the other near the edge of the quarry at the lower right hand corner of the picture. The photograph was taken from a height of about three hundred feet.

Before meeting with any considerable success in kite photography I made a large number of experiments in timing the exposures. A string attached to the camera shutter may be used when the camera is not high above the ground, but at any great altitude the pressure of the wind against the string is apt to cause a premature exposure. I have set off a camera by means of a traveler which sailed up the line and struck a projecting spar on the camera carriage, but this method resulted in blurred pictures, owing to the shock of the collision. I have also attached a sail to the camera and carriage allowing the whole apparatus to sail up the line until a projecting spar struck a piece of tin secured to the wire, when the exposure was made. The sail was then released and the camera slid down the line ready for another trip. But the pictures thus taken were very badly blurred, and the scheme was eventually given up after the camera struck the projection so hard as to be detached and hurled to the ground from an elevation of 1,700 feet. Fortunately, nothing was injured but the camera itself, although it fell right in town. Electricity has not been tried by the writer, as it calls for too great a weight of wire and insulation.

In spite of the experience of others who have taken photographs from kites, balloons, high buildings, etc., all of whom advised extremely short exposures, the writer has made dozens of exposures on bright sunshiny days, during the brightest part of the day, giving them one twenty-fifth of a second at F/8 or U.S. 4, with absolute failure, although enough details were visible to show that the shutter had opened. This was true even with very rapid plates.

Fig 3.—Kite and camera en route to the field.

Fig. 4.—The preferred form of camera bracket.

Fig. 5.—Looking down on a quarry from an altitude of 300 feet.

The Submarine Violin

THE Navy Department has adopted a "submarine violin" for the transmission of messages between submarine torpedo boats and shore stations or other vessels. Exhaustive tests of the apparatus have been made on a submarine at Hampton Roads, Va., and three sets of the signal device have been ordered to be placed on as many vessels.

The mechanism is an adaptation of the violin. From one side of the submarine project two steel stays. From the ends of these is stretched taut a piano wire. Touching the wire is the roughened rim of a wheel which, when it revolves, sets up vibrations in the wire. The wheel is controlled by a motor inside the hull of the submarine and the motor, in turn, is controlled by a Morse key. When the key is pressed the motor begins to revolve, the exterior wheel scraping the wire precisely as a bow agitates a violin string. The hull of the submarine acts as a sounding board. The key is used precisely as an ordinary Morse key and dots and dashes are hummed on the wire as the key is depressed and released. About eight words per minute is the best speed so far attained.

The receiving apparatus is the ordinary telephone receiver. The end under water may be connected by insulated wires to a fort, shore station or another vessel.

The experiments at Hampton Roads showed that the vibrations may be heard clearly at a distance of five miles. Naval officers believe that the device can be perfected so that the range of the mechanism may be greatly extended.

Christian Berger, an Austrian, is the inventor of the submarine violin. He attempted to get the Austrian government to make tests of it, but failed. Coming to the United States, he succeeded in convincing Navy Department officials of the practicability of the scheme.

The signal is a simple device and does not get out of order easily. It is available at all depths. It is expected to add not only to the ease of communication with submarines operating in harbors or in close proximity to war vessels in time of war, but will add materially to the safety of the men who go down in submarines, the most dangerous type of war vessel yet devised.

The Lima Geographical Society, one of the best-known organizations of its kind in South America, will celebrate the twenty-fifth anniversary of its founding on February 22nd, 1914.

A New Way of Making Artificial Diamonds

By the Paris Correspondent of the Scientific American

A PARIS engineer, M. B. de Boismenu, claims to have produced small diamonds by a new electric furnace method. It will be remembered that the late Prof. Moissan succeeded in obtaining very small diamonds (of microscopic size) in the electric furnace, but the process required special skill, and in any case the results were merely of scientific interest. M. de Boismenu employs a new principle, which has the advantage of being very easy to carry out in practice by a skilled operator. Moreover, the process will undoubtedly be further improved so as to secure larger specimens than those so far produced, which range up to $2\frac{1}{2}$ millimeters in diameter.

The inventor occupies a prominent position as director of an electric carbide furnace plant in France and conceived the idea that the diamond could be produced by electrolysis of a bath of molten carbide between the usual carbon electrodes.

The furnace used is built of refractory brick and has two carbon electrodes $6\frac{1}{2}$ inches in diameter, one of which can be adjusted by hand. The bed of the furnace is first packed with a mixture of powdered lime and carbon, which serves to hold a trough shaped receptacle made of fused calcium carbide, as this is found best to hold the molten bath within the furnace. The carbons work within this trough, and are packed around with rather large fragments of carbide. By leaving the current on the bath of molten calcium carbide for a number of hours, an electrolytic action takes place by which the carbide is decomposed and the negative pole becomes surrounded by a black carbonaceous mass, in which are found embedded small crystals. These crystals answer to all the tests for the diamond.

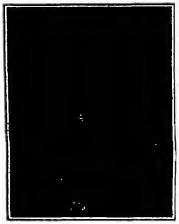
The first conclusive operation was made on April 18th, 1908, in the inventor's experimental laboratory in the suburbs of Paris, using direct current from a small dynamo plant therein installed. After heating up the electrodes, they were drawn one inch apart, and calcium carbide was gradually fed in in small lumps, so as to produce a molten bath. The carbons were then gradually separated until finally they were 10 inches apart. The heat commenced at 11 A. M. and ended at 5 P. M. with a continuous run of 6 hours. The current used was 800 amperes at 84 volts. There were 8 pounds of melted carbide in the bath. At 3 o'clock a pile of carbide fragments were heaped upon the bath, and the whole was covered with a mixture of equal parts of lime and carbon so as to stop up the interstices, and finally the furnace was covered with two refractory slabs. The furnace ran in this way up to the end of the test, when the current was stopped and the furnace allowed to cool off over night. The scoriaceous mass resulting from this operation, weighing from 600 to 700 grammes, was placed in a vessel of water and allowed to remain over night. The residue was examined the next morning. During the night it had disaggregated in the water and formed a black mud, which was decanted and then slowly dried over an alcohol lamp. At once M. Boismenu's attention was attracted by small brilliant points standing out against the black background. He was able to pick these particles out by forceps and thus separated about a dozen of them. They appeared as small transparent crystals of somewhat irregular shape whose size varied from $\frac{1}{2}$ to $1\frac{1}{2}$ millimeters. Under the microscope they showed the characteristic appearance of diamonds. The specimens will scratch a plate of glass under very slight pressure, and the scratches are deep and remarkably clear. Steel can also be scratched by them.

From April 20th to June 5th the furnace made fifteen runs, of which eleven were very successful. The last two of these, the furnace ran for 12 hours with 700 to 800 amperes at 24 to 25 volts, and some of the crystals reached one tenth of an inch in diameter. This seemed to be as far as one could go with the present small plant, and a new one will be required for further work. The specimens were submitted to two jewelers of Paris, who were unable to distinguish them from natural diamonds. One of the largest specimens could even be cut, and the author sent it to Amsterdam for the purpose. It was returned cut with thirty two facets with remarkable dexterity.

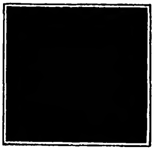
M. Boismenu hopes to be able to continue his experiments in the near future provided that funds are forthcoming for installing an electric furnace plant upon a larger scale. In closing we should mention that the process has been patented by its author.

Diamonds obtained in a nine hours' run. Magnified six diameters.

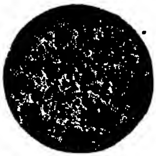
From ten hours' run. Enlarged nine times.



Some of the results of a twelve hours run. Enlarged six diameters.



Diamond obtained on June 3rd. Englarged fifteen diameters.



Scoriaceous furnace product in which diamonds are found embedded

Diamonds produced in the electric furnace

A Bed in the Open for City Dwellers

SLEEPING outdoors is one of the luxuries of camp life that is becoming popular among dwellers in the city. Heretofore only those who had ample house room for a sleeping porch could enjoy the fresh air and sound rest that goes with an outdoor bedroom but a western inventor has solved the problem for the benefit of those with limited space, even apartment house dwellers can now enjoy a night in the open without leaving the flat. The bed is built upon a balcony that projects only a couple of feet beyond the wall of the house. It is protected by a railing and an insect proof screen. By day the bed is covered by a dome of metal that protects it from the weather and at night when the couch is in use the occupant shifts the dome to the inner side of the bed so that the outer side is uncovered. In case of a rain coming on during the night, he can swing the dome back to its original position without getting up. For protection against light showers heavy dew and morning light a waterproof curtain is provided, that is drawn down to any distance following the curved line of the screen. This also secures privacy in the morning. For the convenience of nocturnal readers, a bulb is placed over the head of the bed. For making up the couch the whole body can be drawn into the room, and as readily rolled back into place. Then a few hinged parts are unfolded and an attractive "built in" divan occupies the place where the bed is concealed. This provides the advantage of the ordinary folding or disappearing bed by adding a living room, for use by day, to a small apartment. The device is installed in various private homes and apartments on the Pacific Coast.

Hints in Varnish Making

TRANSPARENT varnishes or lacquers are readily made by dissolving gum copal or gum dammar in the proper solvents. However, it is not generally known that the solubility of gum copal in alcohol is greatly increased by first melting the gum. It loses about twenty per cent water by this treatment and changes its properties. In fact it becomes much more soluble in turpentine. It should be melted at as low a temperature as possible or black specks will appear

By swinging up the dome at the head into the room the bed is opened to the outer air.

The bed is built upon a shallow balcony

By unfolding a few hinged parts the bed may be converted into a divan

A bed in the open for city dwellers.

Pouring electrically refined metal into the ingot mold

Tapping the metal from the base of a blast furnace

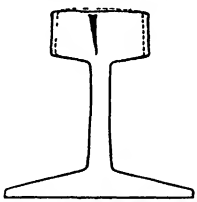
Charging a Bessemer converter with hot pig.

Safety in Travel as Affected by the Steel Rail

The Problem of Producing a Rail Which Will Stand Up Under Heavy Modern Traffic

SO far as the mechanical or material side of the problem is concerned there is no single element upon which the safety of railroad travel depends so greatly as it does upon the steel rail. Also it is certain that there is no single element which is subjected to such brutal treatment in its daily service or that is called upon to endure such varied and destructive stresses as this important member. Furthermore it is certain that the work imposed upon the rail has at least doubled during the past two decades. Not only must it serve as a true plane surface to receive heavy and swiftly moving loads but it must act as a continuous bridge carrying these loads from tie to tie and often because of inequalities of the roadbed supporting the same loads over distances measured between several ties. The steel rail is subjected to severe compression in the height of the summer weather and equally severe tension during the cold of winter. It is exposed to bending, twisting and shearing stresses in every conceivable direction and of constantly varying amounts and these stresses frequently occur with rapid reversions. Finally it is subjected to hammering blows from poorly balanced locomotives which alone call for a very high quality of material.

In the early days of railroading when speeds were lower and weights upon individual wheels were not one half what they are to day it was possible to use a tough and ductile rail which possessed sufficient hardness to stand long service without being crushed by the traffic. Of late years however the weights of engines and cars have gone up by leaps and bounds and contemporaneously with this increase has been a great increment in the average speed both of passenger and freight trains. The earlier and comparatively soft rails failed to stand up under these loads and the composition was changed so as to include a larger percentage of carbon giving a corresponding increase in the hardness. With this advantage came the disadvantage of increased brittleness and while the high carbon rail no longer battered down under the heavier traffic it became more subject to breakage.



Rail head split by the cold rolling and wedging action of heavy concentrated wheel loads.

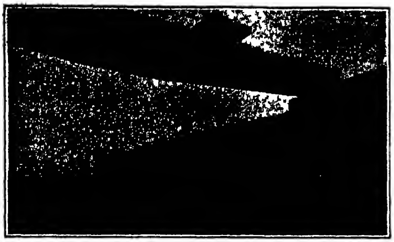
It is the purpose of the present article to give a condensed sketch of the present methods of rail manufacture as generally followed in this country and to point out the lines along which improvement is being sought and in some cases realized.

In the manufacture of the steel from which rails are rolled there are two principal processes: first the reduction of the ore in the blast furnace; second the conversion of the molten iron into steel either in the Bessemer converter or in the open hearth furnace. The raw materials of manufacture consist of iron ore, coke and limestone in proportion of two pounds of ore to one pound of coke and one third of a pound of limestone. The ore is reduced in the blast furnace, a huge steel shell, brick lined, which varies from 75 to 90 feet in height. The materials are loaded into bins back of the blast furnaces from which they are drawn off into skip hoists and by them carried to the top of the furnace. Here the contents are discharged into a cone shaped hopper from which they descend into a second hopper immediately below it with space between forming a chamber on the principle of the air lock. By this arrangement the escape of gases from the furnace is prevented. When the lower hopper is opened by lowering its cone the materials fall evenly over the top of a charge already in the furnace. From the top of the furnace the gases are conducted by a large steel pipe to a set of four or five hot blast stoves filled with fire brick where they are ignited and serve to raise the brick to a high temperature. The air blast for the blast furnace is passed through the heated stoves, and the air as thus heated to a temperature of 1,000 to 1,400 deg. Fahr. is conducted through tuyeres into the bottom of the blast furnace. About one third of the gas produced is required to heat the stoves and the remaining two thirds is used either as fuel under the boilers to generate steam or as in the case of the Gary Steel Works used directly in large gas engines. At the Gary works the power so generated is used in the rail mills, merchant mills, bridge works and mills for rolling steel sheets.

When once a blast furnace has been started it is maintained day and night in continuous operation. The temperature ranges from about 500 deg. Fahr. at the top of the furnace to 2,600 or 2,800 degrees at the base. The molten iron and slag collect at the bottom of the furnace from which they are cast into ladles mounted upon trucks, each of the ladles being capable of holding as much as 50 tons of hot metal. The ladles are drawn in trains of five or six to the mixers—large iron receptacles capable of holding from 400 to 600 tons of

Pouring a heat of steel from a Bessemer converter into the ladle.

Electric furnace tipped over and discharging into the pouring ladle.



Eleven rails lifted at once by the electro-magnetic crane.

The hot saw cutting the finished rail into rail lengths

molten metal—from which it is discharged as required into trains of ladles and taken either to the Bessemer converters or to the open hearth furnaces.

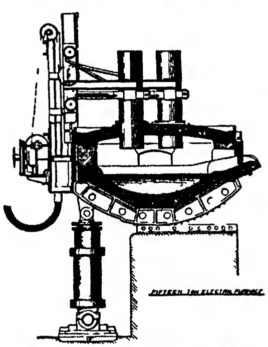
Up to this point the product is simple molten cast iron which, if run into molds would form the common cast pig iron of commerce. From this point on the process is one of converting the cast iron into steel of the required composition and quality.

Hitherto, steel for rails has been known either as Bessemer or open hearth, these two being the main processes employed in the production of steel in such large quantities as are required for steel rails. During the past few years however thanks to the enterprise of the United States Steel Corporation it has become possible to produce rail steel in commercial quantities by the use of the electric furnace—a subject to which fuller reference will be made later in the present article.

The famous Bessemer converter is a barrel shaped wrought iron or steel vessel lined with refractory materials and carried on trunnions through which an air blast is conveyed to the bottom of the converter which it enters through some two hundred separate half inch air holes. The converter is swung over in the direction of the ladles of hot metal and charged with about fifteen tons. The air blast is turned on and it is then swung into the vertical position. As the air rushes up through the molten mass, the oxygen combines with the carbon silicon manganese etc in the iron raising the temperature to about 3100 deg Fahr or 700 to 800 degrees higher than at the beginning of the blow. In eight or ten minutes time all the impurities and practically all of the carbon have been burned out leaving only nearly pure iron. As pure iron is a comparatively soft metal so soft in fact that it may be cut with a pocket knife it is necessary to combine with it elements that will produce the requisite degree of hardness to resist the crushing and abrasive action to which the rail is subjected. The most available substances for the purpose are carbon and manganese about one half of one per cent of the former and one per cent of the latter, being the proportions generally employed.

The converter is then swung over on its trunnions and its charge is emptied into a fifteen ton ladle and at the same time a certain amount of molten spiegeleisen is poured into the ladle with the iron the proportion being such as to introduce into the metal the proper amount of carbon and manganese for the quality of steel rail that is to be made. The hot metal is then drawn off from the bottom of the ladle into a series of rectangular cast iron ingot molds measuring about 22 inches square in section and about six feet in average height.

In the open hearth method the metal from the mixers is poured into large closed furnaces each furnace in the later and most modern plant containing as much as ninety tons. A certain amount of steel scrap iron ore and limestone is added. The charge is then subjected to the fierce heat of burning gases which enter at one end of the furnace pass over the charge and leave through flues at the other end. From time to time samples are taken from the furnace and tested. The ultimate object of this treatment is the same as that of the air blast in the Bessemer converter and although the operation consumes much more time it possesses the advantage that by means of it certain grades of metal not suitable for making Bessemer steel can be utilized. The impurities are oxidized out of the metal and the various alloy additions are made until the proper percentage of carbon manganese etc for the particular grade of steel that is being made has been reached. The metal is then ready for pouring into the ingot molds.



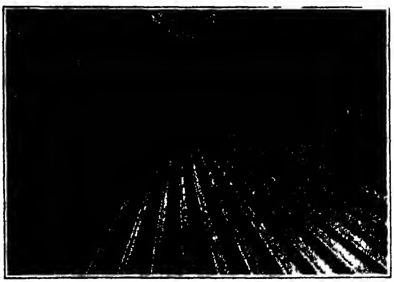
Section through a fifteen ton electric furnace

The process of rail making as thus far described applies broadly to any large rail making mill. The description that follows is based upon a visit recently paid to the works of the Maryland Steel Company and applies particularly to the methods followed at that plant, the rails from whose mills have shown particularly good results during the past few years. The excellence of the product is due largely to the good quality of the Mayari ores which come from the company's mines in Cuba. These ores contain nickel and chromium and are unusually low in the deleterious phosphorus. In addition to possessing excellent ore the company at this works pays particular attention to the ingot treatment.

At the Sparrows Point mills special effort is made to reduce segregation that is the tendency of the constituents of the steel to separate out during the cooling of the metal in the ingot mold and form certain centers in which these separated constituents are concentrated. Nothing not even the pipe itself is considered more pernicious in destroying the quality of a steel rail than segregation. To prevent or reduce segregation the metal is poured into the mold at as low a temperature as practicable in order to facilitate early solidification and the ingots are placed in the soaking pits as soon as possible after they have been cast in order to conserve their heat as well as to produce a better surface on the rail. In the soaking pits the temperature of the ingot is equalized and it is then taken out and given thirteen passes through a thirty six inch blooming mill in which it is reduced to eight by eight inches in section. Nine per cent of the original ingot is cropped off to remove the pipe and segregated material and the blooms then go to a 27 inch rail mill where it makes six passes in the first four in the intermediate and one pass through the finishing rolls. In the finishing rolls the brand mark is rolled into the rail as is also the number indicating the position of that rail in the original ingot. The rails are then run on to the hot bed and allowed to cool. From the hot bed they go to the straightening press after which all burrs and irregularities are chipped off and the splice bar holes are drilled in the ends. It should be explained here that the rails are cut to length by high speed circular saws and that they are cut sufficiently longer than their

(Concluded on page 524.)

Electric crane handling an ingot above the soaking pits.



The hot bed on which the finished rails are left to cool

The Problem of the Small Farm Tractor

Agricultural, Mechanical, and Economical Factors that Must be Considered

By Lyne W. Ellis

THE horse is by far the most flexible motor for small jobs. The tractor cannot compete with him in much of the necessary work of the farm. The weight and cost of materials for a given horse power decrease as the machine grows in size. The unit cost of labor in producing the small machine is higher and the cost of operating also. The cost of distribution per unit of power will possibly be offset through the greater number of possible buyers.

As yet the small farmer cannot supplant all his horses with a small tractor. The man with sixteen horses worth $3,000 to $2,400 as a minimum can keep four for light work and with the proceeds from the sale of the others buy a tractor that will do the work of the original sixteen. The small farmer must keep a larger percentage of his original number and must now actually increase his investment with the purchase of a small tractor.

The proportion of power delivered to the plow by a machine necessarily decreases as the weight per horse power is increased, leaving less and less power for plowing as the machine grows smaller. The width of a machine cannot be decreased as fast as its power. Both these factors and the absolute necessity of keeping the tractor from traveling over ground that has previously been plowed concentrate the weight at one side instead of the center. The resulting side draft lessens the durability and increases the difficulty of steering the machine. Moreover the tractor that does not plow out its own width is charged with additional compression of the soil through increasing the number of trips over the field in proportion to the total number of furrows. The one-unit plow puts the power directly ahead of the load. The four horses abreast gang plow necessitates the use of an equalizer, a vexatious problem with the farmer who would like to overcome a natural but inexorable law of mechanics.

It seems then that the small tractor faces serious problems, the nature of which may explain the slowness with which an apparently overwhelming demand is being met by the manufacturers who naturally would be the first to profit. Not over twenty-five small tractors are now being advertised but there are literally hundreds of small tractors of various styles in existence, with many departures from the standard type of tractor that has proved so successful in the larger sizes. Those that will be touched upon are only a few of the great number that will illustrate the ingenuity that is being displayed in the attempt to solve this problem.

A Small Cheese Copy of the Big Tractor Will Not Do.

Probably the greatest number of small tractors are built in the attempt to reproduce the large or medium sized machine on a smaller scale, not sacrificing any of the versatility of the ordinary tractor in an attempt to solve the peculiar difficulties of the small one. It seems quite feasible to make a tractor weighing approximately 3,000 pounds, developing ten or twelve horse power at the drawbar and twenty to twenty-five horse power for belt driving purposes. Several of the larger tractor builders have accomplished this without difficulty. Not one, however, has as yet developed a commercial success equal to what has been achieved with the next larger size, having the power of about fifteen horses in draft and thirty horse power at the belt pulley.

The small tractors that follow the general lines of the larger ones range in weight from about 1,000 to 5,000 pounds. The greater number attain this lightness at a sacrifice of simplicity, that is by the use of two-cylinder or four-cylinder motors. The motors are usually of the automobile type, running at 500, 800 or even 1,000 revolutions per minute. They are therefore naturally flexible as to speed, and even at the expense of additional cost they are nearly all equipped with two or three changes in gear speeds. They are made for traveling at approximately 1½, 2½ and 1½ miles per hour, varying, of course, with individual designs. These speeds represent a high speed for hauling light loads or returning with empty wagons, a medium speed for hauling loads and plowing, and a slow speed for getting out of difficulties, climbing hills or moving heavy loads for moderate distances. The high speeds are used for harvesting, drilling, harrowing and other work not requiring much draft. Tractors of this size usually handle two plows easily and three under favorable circumstances. Naturally the plowman is dismissed with and one man runs both tractor and plows.

An interesting mechanical difficulty is met in the operation of plowing with a tractor of this type. A large tractor with a gang of six to a dozen plows has sufficient power to break off a single plow in case it meets a solid obstruction. When the small plow strikes a stump or stone the light tractor is checked and some designers have felt it necessary to provide a friction

One of the many "general purpose" tractors that will haul loads to market or draw farming implements.

A light-weight tractor with a two-cylinder eighteen brake horse-power engine.

Steel hoof tractor preparing the ground, hauling drag and roller, and sowing seed. The machine weighs about 5,000 pounds and develops twenty-two horse-power.

View of a four-cylinder front-drive tractor with a series of under-mounted plows, at work on an ordinary sized farm

Another of the many small tractors with special drive wheels.

A machine especially designed for orchard cultivation. The engine is rated at twenty to twenty-five horse-power. The tractor is here shown dragging

A motor plow and cultivator that will straddle a row of corn or go between two rows. A five horse power motor runs it as fast as a man cares to walk all day

A two-cylinder nine horse-power motor propels this little plow

Self-contained traction plow, with one power lift plow slung underneath the tractor frame.

Three-wheel gasoline orchard tractor. Plowing speed, two miles per hour, hauling speed, six miles.

A light-weight California tractor with special hoof-like wheels for use on soft ground.

A French automobile mowing machine. In the background an auto-cultivator

A French auto-cultivator for intertilled crops. Cultivator shovels are underneath the frame.

The wake of a California orchard tractor. Note how closely it runs between the rows.

contact at some point in the transmission so as to allow a sudden stop without serious damage to the driving mechanism.

How Wide Should the Tractor Be?

One difficulty that has already been mentioned is the matter of width, and considerable thought has been given to the matter of reducing this as much as possible. In one small tractor this has been reduced until there is a width of but sixteen inches between the drive wheels, each of which is twenty inches in width. The weight of the machine—a single-cylinder—is but 6,000 pounds. Nearly three fourths of this is supported upon the drivers and since the bearing surface is so large the weight per square inch upon the ground is far below that of the average horse's hoof. A pressed steel frame which serves also as a gear case is one of the features of this machine, making for strength, lightness and compactness. The gears are all of steel machine-cut, and the machine shop equipment of the small farmer has been kept in mind with the result that the heaviest piece on the entire machine weighs but 300 pounds and can be put in place by two men.

An interesting variation from the ordinary type is a tractor with four drive wheels. The use of four traction wheels is claimed to reduce the weight that is necessary because the number of points of contact is increased and the concentration of weight necessary for traction at one point is avoided. Several builders of small tractors have sought to lessen the side draft by running one drive wheel in the furrow, either allowing the machine to operate with the axle out of the horizontal or else providing an adjustment whereby the right hand driver may be dropped downward without unmeshing the gears. One tractor uses the front right hand wheel as a steering guide by facing it on the inner side next the furrow wall with a circle of sheet steel.

The Orchard Tractor

Small tractors for orchard work are being developed with surprising rapidity. The success of the commercial orchardist on the Pacific Coast has been due largely to cultivation and the man in the East is also learning to keep the ground under the trees stirred continuously throughout the season. This calls for a low down, light, short turning tractor. At least a half dozen which embody these essentials have been offered the public in the last two years.

The most widely distributed one to date weighs 8,200 pounds without extension rims or the shields which are sometimes put on for cultivating in orange orchards. A peculiar, basically patented feature of this machine which has been somewhat closely imitated is the arrangement of the cleats on the drive wheels so that they enter the ground in the same direction as the horse's toe. The pressure upon the soil is backward instead of straight down as in the ordinary solid wheel tractor. The ground is left ridged in the path of the machine instead of in a depressed level and is thus more easily crumbled by the cultivating tool. Even when the path of the tractor is not effaced immediately afterward the loose soil tends to fill up the depressions and thus to establish a protective mulch.

One similar tractor has a combination of rubber tire and these peculiar cleats to adapt it for rapid travel on the roads. Nearly all of the orchard tractors are of three wheel type to allow of shorter turning. As might be supposed the horizontal cylinder is used more frequently than the vertical in order to keep down the height. Successful orchard tractors have been developed that stand less than five feet high even with limb shields. They are able to go close to trees and handle plows or cultivators without injury to the limbs.

One orchard tractor is provided with a large steel hood which can be set on or off easily and which when in place leaves no sharp angles or projections to damage trees or fruit. When the hood is not needed it can be taken off and a cab substituted. An extra set of wheels lower than ordinary is provided in order to change the regular type of tractor into the orchard type.

The admitted difficulty of plowing close to the corners in fenced fields with a tractor and trailing plows has led many inventors to design machines in which the plows could be raised clear of the ground and the machine backed up into the corner. One quite well known autoplow handles three plows directly underneath the frame. The drive wheels are in front, the rear wheel being used for steering. The plows are lifted and dropped by a power device. The outfit is handled about like an automobile, and almost as easily.

Another illustration shows a single-plow tractor with the plow underneath the frame and close to the right hand side. One front wheel runs in the furrow to assist in steering. The driver sits in front and the plow is handled entirely by power. The same maker hitches the plows immediately behind in using two bottoms. In this case the driver sits in the rear. The tractor with

(Concluded on page 525)

A Safety Parachute for Airmen

A. LEO STEVENS of New York city has invented a novel compact safety aeroplane parachute. F. R. Law and Arthur Lapham with its aid have made all told a score of leaps into space from bridges, buildings, speeding aeroplanes, exploding balloons and the like without mishap.

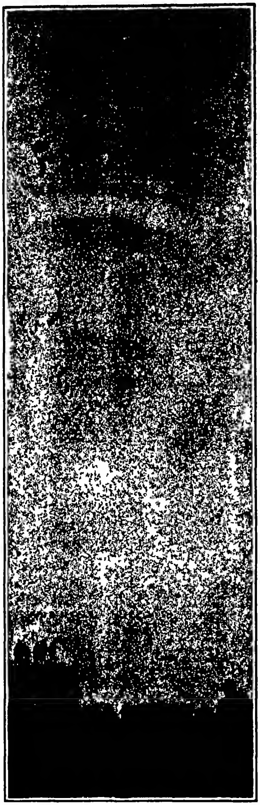
As shown in our illustration, the parachute is rolled up into a pack worn on the aviator's shoulders like a knapsack. It is wrapped in a square piece of cloth which when the parachute opens remains with the harness of leather straps by which the aviator is supported. Instead of the harness which was used by Law, a leather belt is all that is necessary.

When made of Japanese silk this new safety parachute weighs only 4½ pounds complete. It is 16 feet in diameter and is attached by 16 Italian hemp ropes to a spreader bar of steel tubing filled with hickory, which is located 15 feet below the parachute when open. A wire rope having a breaking strength of 1½ tons is secured to the spreader and the supporting ropes are fastened to the strong cable. Two additional ropes two feet shorter than the main ones run to the 12 inch hole in the center. These ropes receive the initial strain when a drop is made, assure the proper opening of the parachute, and put an equal strain upon the top by drawing down upon it. The rush of air against the folds, however, is what really opens the parachute. So sensitive is it to this, that it is designed to open within 100 feet. The jumper also holds in his hand a small cord, by pulling which he opens the parachute in case he has only a short distance to fall.

On the sensations of the aviator when his machine is suddenly relieved of 150 pounds weight, Mr. Harry B. Brown has this to say:

"When I reached an elevation of 4,000 feet, I motioned to Law to prepare to give me a return motion of the hand indicating that he was ready to go. I nodded my head and away he went. I saw no more of him until I reached the starting point some eight minutes later, when I was notified that he reached the earth 2¼ minutes after making the jump. As he released his weight from the moving machine I felt myself go up rapidly and the machine acted very much as if it were suspended by a cable and was being pulled up rapidly by jerks. This lasted for perhaps ten seconds. The machine all this time was on an even keel."

That such parachutes are not an absolute provision against accidents which may prove fatal, is shown by the harrowing experience of Arthur Lapham on May 30th at the Aeronautical Society's flying carnival, held at Oakwood Heights, Staten Island. With the Stevens pack upon his back, Lapham was to drop a mile from a Wright biplane piloted by H. B. Brown. At a height of a few hundred feet—three hundred, according to some spectators—instead of the promised mile, Lapham slid from his seat and shot down. The parachute did not open, probably because the drop was too short. Fortunately for Lapham, he landed without injury on the marshy salt meadow flats near Prince's Bay. He was buried up to his armpits in mud and had to be dug out.



First parachute drop ever made from an aeroplane.

Capt. Berry dropping from Antony Jannus' Benoist biplane at St. Louis, Mo.

Over $100,000 in Prize Money for a Safe Aeroplane

ACCORDING to *La Nature*, the Union for Safety in Aeroplanes of Paris is to hold a contest in order to recompense the inventors of apparatus which will bring an important contribution to the security of heavier-than-air machines. The funds for prizes have all been subscribed, the sum actually raised being 582,000 francs ($116,400). A main prize of 400,000 francs ($80,000) will be given the inventor of a machine or device that, in the estimation of the judges, has an exceptional interest from the point of view of safety. This *grand prix* will not be divided. In addition to it other prizes aggregating not less than $4,000 more will be given to other inventors of important devices. The judges consist of fifteen members, ten of whom are named by the Union, one by the Minister of Public Works, one by the Minister of Marine, and three by the Minister of War. It is to be hoped that the large sum subscribed will be the means of stimulating the solving of the problem of safety in aeroplanes.

Lapham ready to jump with the Stevens pack on his back.

Harry Brown and F. R. Law in a Wright, showing the latter's safety pack in place.

Lapham just after jumping. The parachute opens in a few seconds.

Red Light as a Preservative of Milk

INTERESTING experiments have recently been made concerning the influence of red light on milk. That light as such is detrimental to the conservation of milk has long been known, but which of the rays really did the mischief has only now been determined, when it was found that the red rays are beneficial, while those toward the violet side of the spectrum caused the milk to "turn." Pure, fresh milk placed in an uncolored glass bottle in the full sunlight, and sterilized and pasteurized milk, placed also in uncolored bottles in the same place were found at the end of the day to be completely spoiled and unfit for consumption.

Absolutely no difference could be detected between the ordinary "fresh" milk and that which had been sterilized—both were equally bad. But if even unsterilized milk is placed in a red bottle or in a bottle wrapped in red paper in the full sunlight it keeps perfectly good for ten hours. In Holland much care is being expended on delivering pure milk to the public. The "fresh milk" is brought around by the milkmen in large, covered, brass vessels placed on small hand-carts. On these same hand-carts are open holders to contain the bottles of pasteurized or sterilized milk, which costs rather more, but to which many people give the preference, as it is considered more hygienic. Now, however, that experiments have proved how easily even this pure, sterilized product "turns" by the influence of the light, it may soon be expected that every dairy will adopt red bottles. Until a sufficient quantity of such shall have been manufactured, the bottles will be wrapped in red paper.

The Electrical Stimulation of Plant Growth

THE question of increasing the growth of plants by applying electricity in various ways is one which is being discussed at present. One of the principal workers in this direction in France is Lieut. Basty, and he is now engaged in making some very interesting experiments upon the growth of crops. The excellent results which he obtained have attracted the attention of the Agriculture Department, and the minister is now having the matter taken up from a scientific standpoint. Lieut. Basty is now proceeding in his experiments, upon the basis that the atmosphere is an inexhaustible source of electricity, and on the other hand physiologists assert that the electrical effect serves to hasten and also regularize the circulation of liquids in the capillary tubes, such as those of plants. If we cause electricity to act on the stalks or roots of a plant, the circulation of sap is stimulated and made more regular, so that the growth of the plant is more rapid and the assimilation better carried out, hence the production from the plant will be more abundant. This idea seems to be borne out by an actual increase in the amount of crops which the author finds. He collects atmospheric electricity by small lightning rods which consist of simple iron rods ending in a non-rusting point. For vegetable gardens, the rods should be about 3 feet high, but for field crops such as wheat and other cereals, hemp and the like, the rods should have 6 feet height. The diameters are from ⅛ to ¼ inch, and the rods are driven in the ground for 8 or 10 inches, according to the length of the roots of the plants. It is found that the action is exerted on a radius on the surface of the ground equal to the height of the rod. In practice, the cost of such rods and the labor in mounting them is very small. The following figures for the increase in the growth of certain crops may seem surprising, but they are given on good authority. For potatoes, instead of 100 pounds as before, he now obtains 173 pounds. Beets show 160 pounds. Hemp, for the stalk, 323 pounds, against 100 pounds in all these cases.

The Ten Greatest Inventions of Our Time

We hear much of the great inventions of the past—the telegraph, the sewing machine, the telephone, the reaping machine, photography, Bessemer and open hearth steel, the steam engine and the phonograph. Yet the inventions of our own time are as epoch-making and as dramatic as these.

Perhaps because we have become accustomed to the use of the old machines and discoveries, perhaps because the achievements of latter-day inventors succeed one another so rapidly that we are not given much time to marvel at any one of them, we have not fully realized how stirring and wonderful are the products of modern ingenuity.

Only five years ago the man-carrying aeroplane made its first public flights, only the other day hundreds of passengers on a sinking ship were saved with the aid of wireless telegraphy. At least a dozen inventions as great have been perfected in our own time, and all of them have made a man's work count for more than it ever did before, and have made the world more livable than it ever was.

Why should we not tell the story of our own deeds? Why should we not pass in review the new industries created by men who are still living, men whose names will go down into history with those of Watt, Morse, McCormick and Howe?

That was the underlying idea of the November Magazine Number of the Scientific American. We knew that the "ten greatest inventions of our time" was a big subject when first we planned the number, but how big it was we never realized until we surveyed the field of modern invention.

Then we saw how astonishing was the progress made in our own day, how much mankind had benefited by the inventions of great modern intellects. We began to appraise inventions, to weigh one against the other, and to determine in our own minds which ten had contributed most to human progress and happiness, which were really great pioneer inventions, and which merely remarkable and valuable improvements on successful past conceptions. There were so many achievements to consider that it was hard to arrive at a definite conclusion.

The upshot of our own thinking has been to leave to our readers the decision.

What Are the Ten Greatest Inventions of Our Time, and Why?

For the Three best articles on the subject, we offer in the order of merit, Three cash prizes:

First Prize: $150.00 for the best article
Second Prize: $100.00 for the second best article
Third Prize: $50.00 for the third best article

On another page in this issue will be found the rules that will govern the contest.

Notes for Inventors

A Device for Preventing Rail Spreading.—Percival H. Truman, of Evanston, Ill., assignor to Laas & Sponenburg Company, has secured a patent, No. 1,060,037, for a construction to be applied to a railroad rail. It has a flat vertical surface against which the base of a rail may abut at different heights, a projection at the upper end of the vertical surface to bear against the vertical web of the rail under the tread, and an oppositely projecting base portion which in practice is spiked to a tie.

A Leak Stopper for Boats.—Herman Flugeltaub, of Minneapolis, Minn., assignor of one half to William Weisman of the same place, has patented a device for stopping leaks in boats which includes a housing applicable to the outer face of the hull of a boat to stop the leak and adjustable to cover more or less of the surface of said hull The housing is expansible and contractible in securing the telescopic adjustment desired. The patent is No. 1,060,177

A Number of Train-signaling Patents.—Andrew J Allard, of Richmond, Va., assignor of one third to T F Green and one third to David R. Cressey, Jr, both of Richmond, has secured patents, Nos. 1,060,398, 1,060,400, 1,060,401, 1,060,402, 1,060,403, 1,060,405, for electric signaling and controlling means, also patent No 1,060,399, for electric train-controlling means, No 1,060,404 for train-controlling means and Nos. 1,060,407 and 1,060,408 for electrical block-signaling systems.

A Novelty in Baseball Gloves.—Charles M King of Washington, D C, assignor to A G Spalding and Bros., has patented a baseball glove and mitt, No 1,056,909, which has a flexible palm and a back portion and suitable padding, and the palm portion is provided with a plurality of perforations and a reinforcing layer of flexible material is secured upon the back of the palm portion

Utilizing Worn-out Car Wheels.—Edwin E Slick, of Pittsburgh, has secured patent No 1 055,672 for a method of utilizing worn-out car wheels in which the wheel is heated and the web is thinned by rolling and forcing the displaced metal radially outward into the tread and flanged to reshape the flange and tread and simultaneously increase the diameter of the wheel

Another Non-refillable Bottle—In a patent, No 1,055,595, to Herbert C Atkins New York city, assignor of one third to Edwin Dumble and John Wegmann each, is shown a non-refillable bottle comprising a white glass vessel and a piece of material sensitive to white light and secured to the vessel so that it will be protected by the contents of the article from the white light Such strip will be affected by the light passing through the vessel but will not be affected by the light passing through the contents of the vessel, and the strip is so located that it will be protected on one side by the contents of the vessel and on the other side by the label

A Collapsible Fire Extinguisher.—In patent, No 1,057,538, John R. Gammeter of Akron, O, shows a fire extinguisher in which there is a collapsible tube similar to an ordinary paint tube and filled with a fire extinguishing agent. It has a nozzle at one end, while at its other end it has a hand roller of large diameter upon which the tube may be wound up and collapsed to put pressure upon the contents and to squirt them from the nozzle.

A Novel Food-product Package.—An unpreserved food product which would be injuriously contaminated by contact with the air is encased over its entire surface with a covering of tinfoil coated with paraffin on the inside next to the food and forms the subject of patent, No 1,057,552, to Alexander J Howell of Syracuse, N Y The original application for the patent was filed January 3rd, 1905.

Butter Packages in the Far East.—In the far East, India, for instance, it is reported that butter when shipped in tins and the tin is opened, the butter deteriorates rapidly, and it has been suggested that butter might be packed in collapsible tubes of tin with screw nozzles [illegible] which printing ink, oil [illegible]

INQUIRIES

Inquiry No. 9[illegible]. Wanted [illegible]

Inquiry No. 9[illegible]. Wanted [illegible]

Inquiry No. 9[illegible]. [illegible]

ointments are sold and from which tubes, butter in desired quantities might be expressed from time to time. Because of the volatile fatty acids in the butter, linings of lead or copper would be objectionable and the tubes would likely have to be made of pure tin Doubtless in carrying out this mode of packing and shipping considerable invention would be required in developing the package into the best form to conveniently serve the described purpose.

Safety in Travel

(Concluded from page 517)

ultimate length to allow for cooling shrinkage, each rail being cut separately and to very exact measurement.

As the rails are rolled, a five-foot piece is cut off and subjected to a drop test. The top of the ingot, because of pipe and segregation, is presumably of poorer quality than the rest of the rails from that ingot, and the drop test is made from this upper section The acceptance or rejection of any given heat depends upon this and other tests, which vary according to the particular specifications under which the rail is being rolled.

The subject of the cause of rail failure is one of the most important metallurgical questions in the whole field of engineering. Formerly it was believed that most rail fractures were due to pipe carried over into the rail from the ingot. To-day it is recognized that there are other causes, some inherent in the rail, more external, which account for most of the failures Many split heads which were formerly supposed to be due to pipe are now believed to result from the wedging and splitting action of the heavy concentrated wheel loads of modern traffic The writer was shown at the Sparrow s Point works a section of a rail which had developed a large vertical crack through the center of the head, which did not however extend to the top surface of the rail This crack was caused undoubtedly by the cold rolling effect of the heavy concentrated wheel loads, assisted, possibly by a slight inclusion of foreign matter or some local segregation The cold rolling effect is not unlike that of the ordinary rolling pin upon the baker s dough, and it takes place when the pressure exceeds the elastic limit of the head of the rail. In the specimen shown to us, the metal had been cold rolled down into the crack which had opened up in the head of the rail, and the two halves of the head had been forced outwardly until on laying the template over the rail as thus spread, it was found that the head had been widened over 3/16 of an inch This is a characteristic example of the so-called "split head' rail, which has become one of the most prevalent types of failure since the great increase in weight of rolling stock and high speeds.

The composition of 80-pound A. S. C E. rails made at Sparrow s Point is depending upon the purchasers' requirements as follows

	Bessemer	Open Hearth
Carbon	40 to .50	60 to 73
Chromium	.20 to 40	20 to 40
Nickel, about	75	75
Phosphorus	055 to 07	.01 to .04
Silicon	06 to 12	.08 to .12
Manganese	75 to 1.00	60 to 90

Rail Steel from the Electric Furnace.

At the time when the demand for a more reliable steel rail was at its height, an entirely new process for refining steel made its appearance on a small and experimental scale. Some French and German engineers attempted to produce a steel having the high qualities of crucible steel, by means of the electric furnace. It was thought at that time the cost of any such process, should it prove successful, would be so great that it would be available only for materials the demand for which was comparatively limited.

At about the same time the United States Steel Corporation decided to use its unlimited resources in investigating the problem and to determine what hope there was of using the electric furnace for the production of an exceptionally high-grade steel in the enormous quantities re-

quired to supply the demand for steel rails. The investigation was carried out systematically, step by step, and it is significant that up to the present time the cost of this practical study of the problem has reached nearly one million dollars. The results, however, have justified the expenditure of time and money, and we present illustrations of an electric furnace capable of treating at one time fifteen tons of steel, which has turned out material of such high quality, that already eight thousand tons of electrically refined steel rails are in the tracks, and most of this has been in service from two to three years. During that time there has not been recorded a single case of breakage—certainly a most encouraging result.

From the photographs and the cross-section which are herewith reproduced, it will be seen that the furnace itself is somewhat similar in its construction to an open hearth furnace. It is so supported as to have a rolling and tipping motion from the charging to the pouring side the movements being controlled by a powerful hydraulic cylinder It should be explained here that electric furnaces are broadly of two types, first, induction furnaces, to which the heat is supplied by currents induced in the bath of hot metal, and secondly, arc furnaces in which the arc is struck between an electrode and the hot metal in the bath, or between two or more electrodes—the metal in the former case being heated only by the fierce radiation from the arc. The fifteen ton furnace shown, which is at the South Chicago Works of the Illinois Steel Company, is of the former type It is provided with three huge electrodes, each about two feet in diameter, which, as they are consumed, are fed down automatically, and maintained at the required distance from the surface of the metal The charge for the bath is taken direct from the Bessemer converters, and the process of refining is as follows

The phosphorus is removed in the basic electric furnace, in much the same manner as it now is in the basic open hearth furnace—by the use of lime and oxide of iron The resulting slag containing the phosphorus is tapped off, and a new slag of burned lime and fluor spar is formed When the slag is molten, coke dust is added, and the resultant carbide of calcium is produced The free carbon, and possibly, the carbide of calcium in the slag, with the aid of the carbon and manganese in the bath, eliminate the deleterious oxygen from the steel

The valuable advantages of the electric over the Bessemer and basic open hearth processes are stated by

"First, the more complete removal of oxygen, second, the absence of oxides caused by the addition, such as silicon, manganese, etc third, the production of electric steel ingots up to eight tons in weight that are practically free from segregation, fourth, the reduction of sulphur to 0.005 per cent if desired, fifth, the reduction of phosphorus to 0.005 per cent as in the basic open hearth process, but with the important advantage that there is a complete removal of oxygen"*

Perhaps the most important advantage of the electrical process is that its product is practically entirely free from segregation—that prolific source of rail failure. Furthermore, the steel is almost perfect in structure, and when magnified one thousand diameters, it shows no oxide or slag inclosures, another advantage of priceless value. The South Chicago experimental and practical investigations give promise that ultimately all steel rails will be made by the electrical method.

The Problem of the Small Farm Tractor

(Concluded from page 519.)

the plow underneath the frame has the advantage of allowing a disk harrow or other implement to be attached close behind. When two plows are used, however, there is scarcely room underneath,

* Paper by William R. Walker, United States Steel Corporation, on the "Electric Furnace as a Means of Producing an Improved Quality of Steel."

and this advantage must be sacrificed. Not a few such outfits have two three and even four plows in the rear with provision for a power lift, usually a chain and clutch-operated shaft.

Distributing the Weight.

Probably the greatest disadvantage of a combined tractor and plow is the fact that the distribution of weight to get the best results in plowing is not the proper distribution when the load is strung out on trailers in the rear. Plowing however is the job requiring the greatest power and these other advantages may easily be regarded as of less importance than the securing of the greatest efficiency in plowing alone.

The great problem of side draft brings out some peculiar combinations. There has been a persistent effort on the part of designers to build a tractor with one drive wheel thus placing the power directly ahead of the plow. One of these which never reached the market had a drive wheel at the right and rear supporting the weight upon one front wheel at the right band side and a rear wheel at the left. Unfortunately the distribution of weight was not properly caculated and the rig carned the nickname "Tumblebug" before it ever had a chance to plow a furrow.

A somewhat more successful application of the one-wheel idea was made with the traction wheel in front. A long triangular frame supported at the rear by two steering wheels close together carried three plows which were lifted by power and released by the foot. One advantage of this tractor was its ability to turn a square corner in plowing. However it was a plowing machine pure and simple making little or no pretense at doing general farm work. For this reason probably it was not a commercial success and was never even advertised to the public.

The next step from the tractors already discussed seems to be the home-made machine. In the SCIENTIFIC AMERICAN for February 1st, the picture of a home-made tractor was shown. Many farmers are mounting their stationary engines upon trucks made out of binder or mower wheels with gear or chain drive and various crude mechanisms. Some motor manufacturers are alive to this situation and are advertising motors to the men who want to build their tractors at home. On the other hand several firms are offering trucks and sets of gears to farmers who wish to build their own machines using the stationary machines they have already installed. It is needless to say that these make-shift outfits have all the economic disadvantages of the small tractor and in addition do not enjoy the advantages of shop design and workmanship. It is not difficult to make a tractor that will run but it is so to make one that will meet all the requirements satisfactorily.

The Self-propelled Cultivator

Just now there is an outcropping of a type of machine which seems entirely logical and in fact an advance of the tractor into a separate field from that which we have been discussing. This is the self propelling light tractor designed merely for cultivating. Even concerns have made such tractors, not claiming them to be sufficiently powerful nor rugged in construction to do heavy plowing. These light machines consist essentially of two high drive wheels with a small steering wheel or trailer to balance the machine. It is claimed that one of these will turn from one corn row into the next and cultivate two rows of corn at one time and is no harder to steer than a team of horses, and much faster.

At present the trend seems to be in the direction of even smaller cultivators, propelled by an engine of three to ten horsepower the driver walking and steering the outfit. Out of all the tractors discussed in a previous article on foreign tractors and tillage machines, a motor of this type alone appealed to the writer as more practicable for the American farmer than what we already have. Since then, at least two concerns in the United States have started [illegible] similar [illegible]

One of these manufacturers advocates his tractor for handling a small turning plow as well as a cultivator. A two-cylinder nine horse power engine of the motor cycle type is used and means are provided to use its power for grinding feed, pumping, etc., when desired. The outfit is very narrow, only twelve inches wide, thus allowing rows of intertilled crops to be placed close together. It is claimed to do the work of one two-horse plow or two one-horse plows, in the latter case cutting two furrows at once. The guiding is accomplished by means of a jointed portion of the left handle which is connected with the axle of the traction wheel. By moving the handle to right or left the axle is moved like that of a bicycle. The plow may be guided and the machine thrown in or out of gear or the speed regulated without letting go of the handles.

The suction of the plowshare gives a remarkable amount of traction for the weight of the machine, which is 350 pounds. On striking an obstruction the spiked drive wheels slip so that the machine may be thrown out of gear. Only sixty-five pounds of the weight is lifted by the handles and the obstruction may easily be passed. Two of the machines may be used together so as to convert the outfit into a riding plow. It also has a spraying attachment and a cutter bar for mowing grass is being developed.

Another motor of this type is made with larger wheels to straddle a row. The manufacturers catalogue is full of interest. It brings out the interesting fact that the farmer who owns an automobile could not afford to use his motor car long for either traction or belt work. The stationary engine on the other hand cannot be moved easily from place to place and a portable engine frequently requires the use of a horse to pull it about. By making the small engine furnish its own motive power the farmer may have this engine whenever he wants it in the field or the wood lot, in the barn or even in the summer kitchen laundry.

It is an impartial machine, working one day for the farmer and the next day for his wife. If there is water to be pumped the tractor will go where the water is and pump it. Any make of small cultivator can be attached and the tractor will work in the corn field or the nursery with equal convenience. The wheels are adjustable so that the space between them may vary from 26 to 42 inches so as to fit any width of corn rows. The left handle is the controlling factor, a slight turn engaging the clutch so that the tractor will move forward at any speed from 1 to 4 miles an hour.

Two belt pulleys are provided, one running at from 300 to 2,000 revolutions per minute and the other from ten to forty revolutions per minute. This of course simplifies the problem of supplying the pulleys for different machines. Further than this a special shaft with the universal joint at either end is furnished so that the motor can be direct connected with a generator, corn sheller or feed mill. The outfit complete weighs 500 pounds and costs $265, or about what a real good draft horse will bring. There seems to be no reason why the mechanical difficulties should not be very easily solved in such a machine nor why it should not prove extremely useful if care is taken to perfect it.

Some Interesting French Machines.

The automobile lawn mower is a familiar sight on large estates and in our parks. Several years ago a leading American manufacturer put out a gasoline mower which was tried out on the farm of the late Senator Dolliver in Iowa. It, however, did not prove a success. At one of the recent French shows an auto-mower was shown as illustrated in the accompanying photograph. It is not known what success has been achieved in the field. In the background of the same illustration is shown the small cultivator previously referred to as having appeared to be one of the few practical machines discussed.

Another new and interesting French model is illustrated with cultivator

shovels underneath the frame The extension rims needed for soft ground are shown in the illustration on the ground, at the rear the smooth wheels alone being used for road work The traction wheels are close together in front, evidently for the purpose of allowing them to go between two rows, while the outside wheels straddle them

The Optimistic Small Manufacturer

From these instances it seems that a great deal of attention is being paid by all classes of men to the working out of tractors for the small farm The fact that no great commercial success has been achieved is not to be taken as discouraging The foremost companies with reputations built up on larger tractors are slow to risk their reputations behind something which may not prove a good farm investment even though mechanically reliable The smaller manufacturers and the inventors are more optimistic and are apt to rush into print at the first indication that their product is at all feasible This arouses an unfounded doubt that the larger manufacturers are making no attempt to solve the problem The chances are however that within a reasonable time one or more will have reached the solution in so far as the question may be solved permanently and satisfactorily

There is no question that the market for a successful small tractor is beyond all comprehension The delay in reaching the solution therefore may argue that farm conditions will have to be changed to meet the limitations of the tractor Our manufacturers have successfully solved the problem of the big tractor for the big farm In Europe where the farms are nearly all small in size attention has been concentrated for a longer time on the small tractor Still as stated in a previous article in the SCIENTIFIC AMERICAN European manufacturers have not met the needs of the small farmer Not one idea that has been advanced in this direction by European designers seems to have escaped a trial on this side On neither side of the water has the ideal been reached However more thought is being expended upon this one problem than on any other farm machine of the present day If a small tractor can be built it is certain to be built within the near future

What is Required of the Small Tractor

The small tractor must do all that a big tractor can do in stationary work It must also plow harrow and even cultivate It must do cheaply the kind of work that would require only one or two horses It must really do away with the horse to justify the investment It must do fairly heavy work and still be economical for light work It must be part tractor part horse part automobile part wagon and almost animal like in its versatility It must be able to run on full load longer than a horse can and because it is insensible it is more apt to be overloaded It will not stand as great an emergency load as the horse yet it must get out of the same difficulties The designer must provide an excess of power for emergencies and yet in some way discourage its constant use.

It is a hard problem and one which has so far resisted solution with one universal type If the solution is to come it will undoubtedly come in two ways first the work of even the small farm will be divided into classes and specially adapted machines provided for each class of work, second it will finally be recognized that the tractor calls for a complete reorganization of the farm As the cost of farm operations increases the necessity for cutting costs will very probably result in a general increase in the size of farm units and the continued sway of a tractor of moderate size—one agronomically feasible and one which will provide continuous employment for the hundreds of alert tractioneers that are now preparing themselves for the new calling.

Safety Construction of Steamboat.—Frank Savoy of Buckhannon, W. Va., has secured patent No. 1,058,[illegible] for a steamboat which has a lower section and an upper


Telephoning from Chicago to New York with a submerged transmitter

section with the lower section readily detachable from the upper section and normally held together by suitable means The upper section is provided with a plurality of wells through which smokestacks and staircases carried by the lower section project In case of accident the lower section may be dropped from the upper section so the latter can serve as a life raft

The Government Document Office

WHEN a publication house sends out in the neighborhood of one million publications each week it must have an up-to-date equipment and all obtainable labor saving devices The Superintendent of Documents August Donath who has charge of the distribution and sales of the public documents issued by the various departments at Washington is proud of the equipment by which his force of one hundred or more employees are able to handle the tremendous output of his office But while this equipment includes automatic mail sackers envelope sealers and addressing machines the actual wrapping is performed by hand It is said that Samuel B Donnelly the Public Printer has sought far and near for a suitable practical wrapping machine and has made many trips to inspect and investigate proposed automatic apparatus which promise to do the work but has not yet found a machine which possesses the flexibility of structure and operation to enable it to function satisfactorily in wrapping and sealing pamphlets and other publications varying in size and thickness A machine which would meet the demands of the Superintendent of Documents would it is thought suffice for any publishing-house and the field should be an attractive one for inventors especially those experienced in the wrapping machine art

Industrial Alcohol

IN the manufacture of industrial alcohol the aim has been to find a cheap raw material and to increase the yield by improved methods of mashing and fermentation Mashing is the process of saccharifying the starchy material into fermentable sugars maltose and dextrin The mash is now fermented by means of yeast the enzyms of which split maltose into dextrose and then into alcohol and carbonic acid gas Theoretically one pound of starch should yield 0 57 pound or 11 5 fluid ounces of alcohol In practice this yield is never obtained but falls at least 15 per cent below it

This low yield is due to incomplete saccharification and fermentation, and the production of by products such as glycerin and succinic acid in the fermenting vat In the brewing of beer the aim is not to ferment all the fermentable matter in the beer wort but to leave considerable extract in the finished beer The boiling of the wort which kills the enzyms of the malt, is therefore no objection The distiller on the other hand aims to completely ferment the maltose and dextrin He depends on the enzymic action of the malt to break down the dextrin into maltose in order to enable the yeast which cannot directly attack the dextrin to ferment the same after its conversion into maltose

It may be remarked here that the complex starch molecule is gradually broken up into dextrin malto-dextrin and maltose by the action of the malt enzym Therefore it will not do to sterilise the distillers mash by boiling as this would destroy the malt enzym on which the distiller depends for his dextrin inversion But in the unsterilised mash the yeast must carry on a struggle for existence with a multitude of wild yeasts and bacteria which set up undesirable fermentations of their own

There are as many varieties or races of yeast as there are varieties of apples While Luther Burbank has given the world new varieties of fruits of all kinds and by skillful breeding has greatly changed the characteristics of certain plants, mycologists have done similar work with yeast. The aim of the distiller is to find a yeast producing a clean fermentation, that is one yielding none but alcohol and carbonic acid gas as its

products The yeast must be able to survive and do its work in mashes rendered slightly antiseptic Yeast races have been acclimated to antiseptics by propagating them in nutrient media to which increments of antiseptics such as hydrofluoric acid have been added Such a hardy race of yeast will do its work in antiseptic mashes in which the ordinary wild yeasts and bacteria are unable to survive

The other object of the distiller is to find a cheap raw material Germany has it in the potato containing 12 to 27 per cent of starch In America the price of potatoes quite precludes their employment Corn containing about 70 per cent of starch would be an excellent material but its price has greatly risen in recent years selling at present for about 60 cents a bushel of 56 pounds in the western corn producing States and its average price for some years past has been 40 cents Pioneers in Nebraska remember the time when it was cheaper to burn corn as fuel than bituminous coal Corn at that time sold considerably below 20 cents Even in the 90's 25 cents was considered a good price The present price of corn as raw material for industrial alcohol is therefore prohibitive

As early as 1854 attempts were made to use wood as raw material Sawdust boiled in dilute acid will become converted into sugar dextrose according to the equation

$$C_6H_{10}O_5 + H_2O = C_6H_{12}O_6$$

Cellulose + water = dextrose

Dextrose of course can be fermented by yeast to produce alcohol Unfortunately the reaction does not take place as readily as the above formula would indicate Prolonged boiling with fairly concentrated acid is necessary to convert the larger part of the cellulose into dextrose The method is laborious and expensive but the day may not be far distant when the difficulties will be overcome and it will be a commercial success

Very recently a good deal of work has been done to utilize the waste sulphite liquors from paper mills In the manufacture of paper the wood is digested under pressure with a solution of calcium bisulphite The waste sulphite liquor coming from the digesters is a dark ill smelling liquor which contains among a variety of other ingredients carbohydrates derived from the wood After neutralization of the acid and other preliminary steps the liquid is rendered suitable for fermentation by yeast In Sweden thousands of gallons of alcohol are annually produced from such liquors and no reason is seen why the sulphite liquors in this country cannot be similarly utilized Sulphite liquor is a waste product pure and simple is difficult of disposal and a nuisance when allowed to pollute the streams its utilization would therefore be not only an economic gain but would also abate a nuisance in many places

The alcohol obtained from wood or waste sulphite liquor by fermentation with yeast must not be confounded with wood alcohol obtained from the destructive distillation of wood

It may be of interest to state here that alcohol can be made from ethylene C_2H_4, a gas contained in coal gas, by treatment with sulphuric acid This artificial production has at the present time only experimental value

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Helps the Paper Hanger—Patent No 1 058 159 to William H Decker of Youngstown O who assigned one third to Emmet S Decker of the same place is for a paper-hanging device in the form of a rectangular frame carried at the top of a pole with one side of the frame open so that the edge of a roll of paper may be exposed for matching purposes Another patent, No. 1,058 185 to James Krondak of Morse Bluff Neb., is also for a paper-hanging device in which there is a frame having a roller at one end mounted in a frame which is pivoted for purposes of adjustment, so the roller can be set with relation to the paper to be hung, while the frame has at its end opposite the roller means for holding the paper taut

NEW BOOKS, ETC.

PSYCHOLOGY AND INDUSTRIAL EFFICIENCY By Hugo Münsterberg Boston Houghton, Mifflin Company, 1913. Price, $1.50

Prof Münsterberg writes in his customary rather self satisfied vein. But despite the irritation which his style arouses his book is of undeniable value The work of the efficiency engineer is not sufficiently recognized to our mind and the importance of the experimental psychologist s is exaggerated He questions Harrington Emerson s statement that 'the competent specialist who has supplemented natural gifts and good judgment by analysis and synthesis can perceive aptitudes and proclivities even in the very young much more readily in those semi matured and can with almost infallible certainty point not only what work can be undertaken with fair hope of success but also what slight modification or addition and diminution will more than double the personal power Of this he rather disapproves despite the fact that workingmen are now engaged according to Dr Blackford s system with astonishing success Too much stress is laid upon the value of experimental tests in determining vocational fitness Much more is required A man may respond splendidly to reaction time tests and may be able to distinguish colors with accuracy but yet may be hopelessly unfit to drive a locomotive engine simply because he s not steady and cautious In other words the type of man to be selected for a particular position plays no part in Münsterberg s scheme Instrumental analysis does not disclose whether a man is a trouble maker whether he is pugnacious whether he is easy going whether he is companionable or whether he is a born leader All that it does is to show whether or not a type once selected wrongly or rightly has good senses and how responsive it is to sense impressions We cannot conceive of any psychological test which would inevitably enable us to pick out the best salesman out of five hundred men But we can conceive of a scientific study of character which would enable us inevitably to select the right man In other words what Prof Münsterberg seems to overlook is the fact that instrumental analysis is not an indication of character

ERGÖTZLICHES EXPERIMENTIER BUCH Von Albert Neuburger Berlin Wien Ullstein & Co 1911

This is a book of scientific experiments which is intended to be not only instructive but amusing and entertaining While the experiments are old many of them having been brought to the notice of amateurs by the late Gaston Tissandier they have been very ingeniously arranged and entertainingly described Some idea of the character of these experiments may be gleaned from their titles Cardboard as a Cutting Instrument Raindrops from Grease Blowing through a Brick and Putting Out a Light The Inquisitive Coin Leaping Papers Frogs and Devils The Perforated Penny The Magic Egg Cannons that Shot without Powder Ice That Cannot Be Cut June Bugs and Bacteria Lamps The Laughing Mirror Tricks With Sealing Wax To the experiments with which amateurs have been acquainted through popular books for some years there have been added many new experiments based upon the more recent discoveries in science The book can be highly recommended to German reading lovers of experimental science

VOLAMEKUM Handbuch fuer Luftfahrer Von Ansbert Vorreiter und Hans Boykow Munich J F Lehmann s Verlag 1913

This is an admirable little handbook of practical information for the aerial navigator whether he sails the air in a balloon a dirigible or an aeroplane No better evidence of the growing importance of aerial navigation can be presented than the publication of such a practical guide book The little volume first of all tells us something about the handling of free balloons and then passes to a discussion of the handling of airships and flying machines Much space is devoted to navigation both terrestrial and astronomical A very complete description of the more important instruments that can be used to guide the navigator of the air is presented Valuable too are the tables and diagrams which give much information on the quantity of gas necessary for inflation the pressure of gases the quantity of ballast required the geographical position of German cities the hours of sunrise and sunset etc. Since the European navigator finds it no difficult task to overstep the boundaries of his own country the final chapters of the book are devoted to telegraphic signals, telegraph tariffs postage rates coin values, and a dictionary of the more common phrases in several European languages

STEEL. Its Selection Annealing, Hardening, and Tempering By E R Markham Fourth edition, fully illustrated New York The Norman W Henley Publishing Company, 1913. Price, $2 50

This is a new edition of a book which was formerly known as The American Steel Worker Since the advent of the automobile the modern gas engine and the flying machine has brought about a demand for extremely tough, strong high-grade steels of various kinds it became necessary to rewrite portions of the book As it stands the work may be regarded as a good textbook on hardening, tempering and annealing steel of all kinds and is a good set of comprehensive and specific instructions on the methods of hardening a large number of tools.

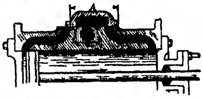
OUTLINE OF ARCHITECTURAL DESIGN By Lee H. McCoy The Athenian Publishing Company, Benton Harbor, Mich., 1913. 8vo.; 156 pp.; illustrated. Price, $1.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12810) C. L. W. calls attention to a trouble he has had with his wireless apparatus due to insects creeping in between the plates of his condensers, thus upsetting the balance of the adjustment. This may sometimes occur, and in case any fault exists which seems unaccountable we would suggest that amateurs look for the bug.

(12811) H. H. asks: A says that the pressure on the back of an ordinary slide valve used on steam engines is equal to the size of the ports. B says it is equal to the total area of the valve. Of course, we have reference to the pressure causing the friction between the valve and the seat. Who is right? If steam ports were plugged perfectly steam tight, would boiler pressure, say 150 pounds, force the valve against



the seat as if there was that much pressure to the square inch of the valve? A. The pressure on the steam-chest side of a slide valve may be taken to be the steam pressure times the area of the slide in square inches. The back pressure in the exhaust port is so variable that it should be ignored. When the outside lap hangs free is practically the only time the pressure is not taken on the entire valve area. In that case the area of the sketch is the one used.

(12812) M. L. writes: I can remember space I saw inside a soap bubble fifty years ago. This particular space is fixed in my memory. Turning to astronomy, I also find it is fixed in the earth's path over thirty billion miles away from this written reference. Does memory then retain immortal form in space through which the world has moved? The subject is well worth investigation by every one. All details of former position in space can be identified in relation with any written or other distinguishable landmark and correspondence. Concerted inquiry is needed to secure agreement as to terms for representation of standard events. A. It is possible to think of any point of time or space at any moment, whether we have ever seen or known that point before or not. We can imagine the action going on at that point and write a description of it. Such are many works of fiction, such as Jules Verne's "Twenty Thousand Leagues Under the Sea." The doctrine of Relativity, which is commanding much attention at the present time, is involved in this conception. You will find this discussed in our SUPPLEMENT Nos. 1917 and 1891, price ten cents each.

(12813) H. K. asks: How can a spectral analysis be employed to prove that the planets, the sun and the remotest fixed stars are composed of matter identical to that of our earth, and how is this done? A. The lines in the spectrum of a substance are always in the same position, and when in the spectrum of a heavenly body the same lines are found in the same position as upon the earth, it is known that that substance is present in that body. For this see any textbook of astronomy. We can send you Todd's "New Astronomy" for $1.45 postpaid. 2. How can the distance of very remote stars be ascertained with reasonable accuracy? Kindly give a geometrical illustration if possible. A. The distance of a star is found by its parallax, which is its displacement as viewed from different parts of the earth's orbit. An illustration of this is in the displacement of a flagpole as we walk in a circle around it. This is also to be found in the book to which we have referred you above. 3. How far has it been proven that every star (fixed star, our sun, etc.) rotates on its axis and revolves in its orbit around some center, as do the planets of our solar system? A. It has not been proven that stars rotate upon their axes. They are too distant for such a motion to be detected.

(12814) J. S. V. asks: Will you please tell me which is correct? I claim it takes more power to pump water in a tank with pipe running to top and flowing over than to run to the bottom of tank (as there is no pressure on the pipe at the bottom, only the size of the pipe, the depth of water in tank). A. If the level of water in a tank varies, sometimes being very low and at other times full, it will require less power if the inlet pipe enters at the bottom, since the pressure is that of the size of the pipe and the depth of the water. If the tank were always full it would not make any difference whether the inlet was at the bottom or the top of the tank. Under a constant head the pressure would be the same.

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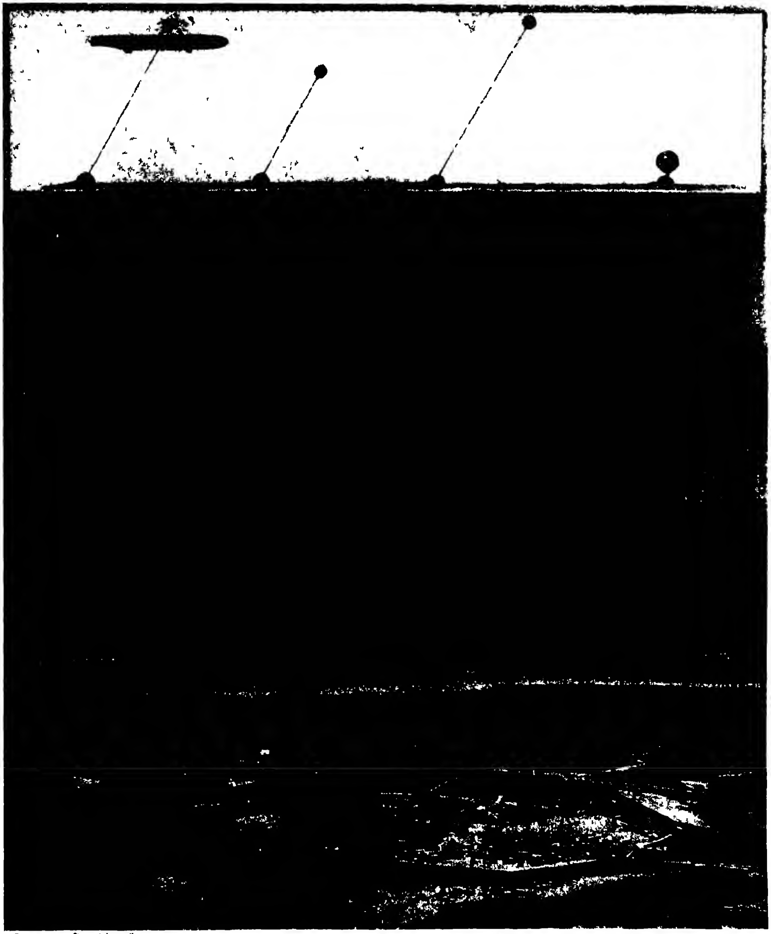

By courtesy of the Illustrated London News.

Ex Engineer Commander George T Simmons, R N suggests the mining of the air as an effective defense against aerial attack These air mines are not to be exploded by contact but are to be set off at the will of observers on watch for that purpose

MINING THE AIR.—[See page 538.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Problem of the Small Tractor

MODERN conditions demand the use of a bigger, faster, and more economical unit for farm work. That is why the tractor has come to take the place of the horse. But how big shall we make the tractor—the modern farm horse?

In the United States there are nearly five million farms of less than 150 acres as compared with a million and a half larger than that. Most farmers are men of small business. There is the greatest human interest, then, in a tractor of the size that will fit the smaller farms, the farms that are operated with from four to eight horses. The small tractor as understood by the public is one that will fit into the conditions where not over six or eight horses at most are used to do all the farm work.

The farmer enjoys a great measure of independence. He is regarded as the last defender of individualism. Neither he nor the average person looks kindly upon any evolution that will rob him of his present status. Public sentiment is in favor of retaining the small farm and preventing the encroachment of the big farm and of capitalistic control. The question, then, is of vital human interest as to whether the tractor shall be reduced in size to take the exact place of the horse, or whether, in response to an economic demand, it shall grow as large as the natural limitations will allow. It is the old story—whether or not the instinct of self preservation shall yield to the modern corporate idea of preservation through organization, the division of labor and the methods possible only when men work together in larger groups.

It is probable that the small tractor pulling two or three plows will some day be widely adopted. A great many more men can raise $1,000 to $1,200 to buy a small machine than $1,000 to $3,000 to buy a big one. The market for a small tractor, once the mechanical and economic difficulties are brought down to an attractive minimum, is enormous. Sales will naturally be easier, and the lack of a satisfactory system of agricultural credit may operate to curtail the sales of the larger power units, even where financial interest and good business judgment would prompt the buying of larger equipment.

The question of how large a tractor can grow in size is apparently settled already by inflexible agronomic conditions. The weight that can be concentrated in a compact, mobile power plant is limited by the fact that the soil of the fields must bear the burden and still raise crops. The railway can increase the size of its engines safely by putting on heavier rails. The soil, however, will support only a given weight without injury to its physical condition. And again there is an engineering problem, that of moving a heavy mass economically when the soil has been softened by rains. Moreover communities have built roads and permanent bridges to sustain only what have appeared to be the heaviest tractors that are now feasible, and in the years to come a fifteen-ton tractor will probably be the largest that can prevail.

It is too early to state what will be the final outcome in the opening of new countries. It is safe to say that tractors will be built as large as natural limitations will permit. We have even seen instances of the combination of several large tractors ahead of a single large plow, also built up of units in order to accomplish greater results with the saving of one or more plowmen. In view of the present great commercial successes and the trend of agricultural economics, it is reasonable to assume that a tractor of medium size, handling four to six plows, will be in greatest demand, and will do the bulk of the work for large farms and farming communities. It is equally evident that in countless cases there will be a field for the small tractor, even though its cost and operating expenses are proportionally higher than for the larger machines. Finally, many special adaptations of the small tractor will be made to accomplish certain functions where the margin of profit is large enough to overcome a natural increase in complexity and cost.

However, a revolution is taking place in the size and management of the farm. With every census the number of non-resident farm owners is increased. Furthermore, omitting the suburban truck patch, the farm is growing larger, even in prosperous agricultural States. The larger enterprises attract a higher caliber of proprietor and manager, and as in all business, the type of organization prevails that allows the exercise of the highest intelligence and mechanical power as opposed to mere manual labor. It is hard for the average person to see that the individual small proprietor is losing ground. Yet the whole tendency is toward centralization.

There is a deep-rooted and commendable feeling that the solution of our soil fertility problems depends upon the working of the land in small units, as in the older nations of Europe. Small farms, hand methods and intense personal interest in the soil, do tend to conserve this fertility. Yet the large enterprise in which brains and mechanical power play the controlling part, save men from physical drudgery. Here in America men are now far too valuable to be used in furnishing power to till the soil. Men are too costly to be used in holding back evolution. And it is to be hoped that the time is far distant when the struggle for existence in America will so cheapen human labor that the mere conservation of the soil will count at least as much as the uplift of the individual.

After all, the soil is not the only resource to be conserved. We need men now in all our industries to take the products of the soil, the mine and the forest, and make them more valuable by the expenditure of increasing skill and labor in factories. The mere production of raw material is not a matter so much for the exercise of skill as for the use of quantity methods, resulting in cheaper costs. The shaping of materials for consumption is a matter of skill for which we now pay vast sums annually to foreign countries—balancing the bill with increasing drafts upon our natural resources. The laborers we release from the soil can all find legitimate employment in another phase of conservation.

The Japanese and the American Navies

IT is a matter of particular importance at the present juncture, in view of the recent crisis, that the people of American should take serious stock of Japanese naval development. The navy of the United States is still incomparably superior to that of Japan, but its superiority is very largely dependent upon ships built during what is known as the "pre-dreadnought" era, and which are therefore in a state of ever increasing obsolescence. The future cannot be guaranteed by a preponderance of units which, whatever their merits when they were built, are now wholly outclassed. The Panama Canal, while it will add to the mobility of the American fleet, increases its responsibilities. The canal affords the navy a shorter route to the Pacific, but it also adds to the dangers that the United States may run in the Pacific. Four years ago M. Sartori Kato, one of the best informed of Japanese publicists, wrote in an English naval periodical: "Whether allowed or disallowed, Japan's insistent aspiration is to be mistress of the Pacific." It will be wise to bear the policy in mind when considering the facts which may be regarded either as the outcome of it or as contributing toward it.

On another page in this issue a comparison of the American and Japanese fleets will be found. The United States has thirteen dreadnoughts built and building to Japan's twelve. The difference in tonnage, such as it is, is slightly in favor of Japan. In gun power the Japanese are 15 per cent better off than we, although they have one dreadnought less.

There is in these facts no cause for panic. Japan has still, at the outside, only five completed dreadnoughts to the eight of the United States, and, taking into consideration the more rapid rate of construction in this country, there is no good reason why the proportion should be altered. It is, however, perfectly clear that the naval superiority of America over Japan cannot be maintained by laying down one battleship a year. From 1911 onward Japan has laid down or ordered eight dreadnoughts to the four of the United States, and another four battle-cruisers, besides minor craft, are provided for in the new Japanese programme. When Admiral Takarabe was placing the new programme before the Lower House of the Japanese diet, he declared that it had been prepared with an eye to the 21 battleships which "a certain Power" might be able to oppose to it. This was, of course, a direct reference to the United States, since no European power is in a position to risk the dispatch of so many ships to so distant a station. It must have become perfectly obvious to every man who examines the situation that a provision of one battleship a year will not suffice to maintain the position of the United States among the naval powers of the world. Between 1901 and 1907, a period of seven years, 29 armored ships were launched for the United States fleet. In the five and a half succeeding years only ten have been launched. No nation can expect to maintain its position in face of such facts as these. With the advent of the dreadnought, costing more to build and to keep up than ships of earlier types, some diminution in numbers was to be looked for, but there is no nation that has reduced its rate of construction to such an extent as the United States. At the end of the pre-dreadnought era the United States was easily second to Great Britain. Germany has now usurped that position, and if the present rate of comparative progress is allowed to continue, it will not be long before the rise of Japan compels America to take a still lower position in the scale.

Research on Leprosy

THE work of Prof. Raoul Pictet of Geneva (Switzerland) on the use of liquefied carbon dioxide as a specific for leprosy, has lately been discussed in the newspapers. Wholesale cures are claimed for it in Hawaii. Pictet's "discovery" is a method of cauterization, but whether more effective than other long used methods along the same lines remains to be seen.

Until recently, leprosy had not been produced in animals for purposes of experimental study, and it is barely four years since the germ was first isolated at the Louisiana Leper House. The work of Duval and Couret in the laboratories of Pathology and Bacteriology at Tulane University (New Orleans) has given a new and sure foundation for future investigation of this disease.

They have established that leprosy cannot be given to any animal by a single injection of its germs, repeated injections are necessary in order to make the body sensitive. This is doubtless true of human beings, and explains the relative infrequency of leprosy even when persons have lived among lepers for some time.

This is in agreement with a long line of new theories regarding the *modus operandi* of infection. Typhoid germs take two weeks to make the body sensitive enough to give the disease a start. During this period of incubation millions of germs may be produced in the course of forty-eight hours, but the disease is not produced until the body reacts. In leprosy it would seem that the germs are repeatedly killed off by the body.

Duval says that "to produce the disease experimentally, it seems necessary to give the animal repeated injections of large numbers of leprosy bacilli at given intervals for a period of months." His research shows that an injection of first four *million* and later of four *billion* bacilli were given before the disease "took." Even after the first injection of four million bacilli and for nearly two weeks after the injection of the culture containing four *billion* "there was no evidence of either localized or general infection." The animal first infected with leprosy was a monkey (*Macacus rhesus*), the initial injection being given October, 1910. It was not until the following March that he was recognized as afflicted with a disease having all the clinical characteristics of "human leprosy," and death did not ensue until December.

Counting the Waves of the Sea

MANY seismologists believe that certain types of microseisms, those of a period of say from four to seven seconds, are due to the pounding of ocean waves on the seashore. In order to test this idea more fully the International Seismological Association, in 1909, voted 1,000 marks to be used by its committee on microseisms in constructing an instrument for registering ocean waves. This "undagraph," as it is called, has now been built, and is described by Dr. Otto Klotz in the *Bulletin of the Seismological Society of America*. The original undagraph was set up in 1911 at Tynemouth, England, on the North Sea, but a location more exposed to the full force of ocean waves has now been found at Chebucto, outside the harbor of Halifax, N. S. An open iron pipe extends into the sea with its mouth below the lowest stage of the tide or wave trough. The other end of the pipe is on land, and is so arranged that, with each incoming wave, the water rises, compresses the air above it, and bulges a diaphragm, which actuates an electrical recording apparatus. The period of the waves is thus registered, but there is not, as yet, any arrangement for registering their amplitude. The recording apparatus will be installed in a lighthouse, and the records obtained will be compared with those of a Bosch seismograph at Ottawa.

Electricity

Electrification on Swedish Railroads.—"Electrification of the lines of the Swedish State railroads from Kiruna to Riksgränsen, says the *Electrical World*, is nearing completion, and the government is now planning the electrification of the large trunk lines from Stockholm to Malmö and from Stockholm to Gothenburg. The former line will receive energy from a plant to be built by the government near the town of Motala, and for the southern part energy will be purchased by the government from a large central station on the river Lagan. The Gothenburg line will be supplied chiefly from the government's plant at Trollhättan. Later the line from Gothenburg to Malmö will also be electrified The cost of the lines at present under consideration will be nearly $30,000,000. The transmission lines, transformer stations and locomotives will cost approximately $20,000,000 and the new generating station will cost in the neighborhood of $10,000,000."

Central Station Investment.—It is estimated that investment in the central station industry is capitalized to-day at about $2,500,000,000 and that the earnings are apparently estimated around $350,000,000. Quoting from the report of Mr T. C Martin, editor of the report of the Committee on Progress before the 1912 convention of the National Electric Light Association, "There can be no great exactness to these estimates, as the general census of the central stations will not be taken until next year, and the last United States report is that of 1907" It is apparently estimated by those who ought to know that the central station income is somewhere around $400,000,000 The *Electrical World* in its issue of January 4th, 1913, gave the following data on the electrical industry

Value of electrical apparatus made	$350,000,000
Electric railway earnings	635,000,000
Central station earnings	450,000,000
Telephone earnings	350,000,000
Telegraph earnings	85,000,000
Isolated plant service	125,000,000
Miscellaneous electric service	125,000,000

Making a grand total of approximately $2,120,000,000

The Naples Subway—According to further details which have appeared as to the construction of the metropolitan electric road for the city of Naples, the franchise for this line was granted last January and it will be built partly as a surface traction road and part in subway, according to the plans now in preparation by the Franco-Italian company, the organizers of the enterprise. The length of the line is to be about five miles, and it will have fifteen stations. In some places the road will run at quite a depth underground, this being near forty feet in some cases, so that it is intended to put in electric elevators at those points. The whole of the line will be laid in double track standard gauge, with a minimum radius of curves of 330 feet in the surface line and 130 feet in the subway The greatest distance between stations is 1,880 feet For operating the electric road there is used a third rail of 75 pounds per yard and it carries 1,000 volts direct current for the motors. Each train is made up of three cars, at least at the first period of operating, with a motor car fitted for second-class passengers at each end and a trailer for first-class in the middle, and the train will be controlled from either of the end compartments on the multiple-unit control system Four 50 horse-power electric motors form the outfit of the motor car and the standard speed is under 15 miles an hour

Pipe-line Telephony in Mines.—A German electrical engineer, O Dobbelstein, is responsible for the statement that a telephone system can be made to work from the interior of a mine to the surface of the ground by simply connecting one side of the telephones to the various metal parts such as compressed air or water pipes, cables, rails and the like, while the other side is connected to earth, in spite of the fact that all the piping, etc, is of course already in connection with the earth. It appears that a system of the kind is now in use in the Carolinenglück mine near Bochum The expense of putting in telephones on this plan is of course reduced to a minimum from the absence of any wires, so that quite an advantage is had. A battery supplying 12 volts is all that is needed to supply the current for the microphone, using an induction coil in the secondary circuit. An ordinary telephone is used as the receiver An electric bell cannot naturally be used on this system in order to give signals, as only telephone currents can be carried. However, a method can be applied in the shape of a mono-telephone relay such as is used on the Mercadier apparatus. This consists of a metal disk which vibrates when current comes into its magnet, and the vibration works a light arm so as to make an electric contact in a suitable way, putting on a local battery circuit to ring a bell, so that signals can be made in this way by the telephone itself. Both permanent and portable telephone sets are used within the mine, and the latter are set up at once by connecting to the rails or pipes and to the ground. Telephones can also be installed in the elevator by using one of the cables as the metal part.

Science

Biological Research in the Philippines.—A large and well-equipped biological expedition organized by the University of the Philippines and the Philippine Bureau of Science left Manila on April 5th, under the leadership of Prof Griffin, for Taytay Bay, on the northeastern coast of the island of Palawan. It was planned to spend two months in an entirely unexplored region.

Earthquakes and Rainfall.—An apparent relationship between the frequency of earthquakes at Tokyo and the amount of rainfall and snowfall in northwestern Japan has been pointed out by Prof Omori, who does not, however, attempt to explain it. The periods when earthquakes are infrequent (but severe) coincide in a striking manner with those when rainfall is deficient at Niigata and Akita, while the periods of frequent (but not violent) shocks coincide with excessive rainfall at those places.

Production of Argon from Hydrogen.—At a lecture delivered on June 1st at the Chemical Institute in Rome, Sir William Ramsay announced that he had obtained argon by the action of cathode rays upon hydrogen in a vacuum bulb with aluminium electrodes. The anode was covered with a thin layer of sulphur A somewhat similar experiment in which selenium was used in place of sulphur gave krypton in place of argon Sir William Ramsay does not consider the results of these experiments as final, but is awaiting further confirmation.

Dr. Mawson is now in more or less regular communication with the world by wireless telegraphy *via* the station established by his expedition at Macquarie Island For nearly a year after his arrival in Antarctica the wireless outfit set up at his base, in Adelie Land, failed to work properly owing to troubles with the gasoline motor that was intended to run the dynamo, and the repeated overthrow of the antenna masts by severe storms. A recent wireless message states that he and his companions are beguiling their time, during their present involuntary sojourn in the South, by publishing a newspaper named the *Adelie Blizzard*. In the middle of May their hut was already nearly snowed up, and penguins and seals had disappeared shortly before the bay became frozen over

Antarctic Explorers in London.—Commander E R. G R. Evans, R.N, C.B, told the story of the Scott expedition at Albert Hall on May 21st, before an immense audience comprising the fellows of the Royal Geographical Society and their friends. Lord Curzon presided. The address, as published in the London *Times*, includes several interesting details not previously made public Captain John K Davis, commander of the "Aurora," the ship of Dr Mawson's Antarctic expedition, recently visited London to report the progress of the expedition and to endeavor to obtain part of the money that is necessary to cover the extra season's work in the Antarctic. Mawson and his little party are now sending daily weather reports by wireless from Adelie Land to Australia.

The Schröder-Stranz Expedition—The precarious situation of this expedition to Spitzbergen was fully reported in the SCIENTIFIC AMERICAN of April 5th, 1913, page 313 From subsequent press reports it appears that the Norwegian relief expedition under Capt Staxrud succeeded in reaching Treurenberg Bay, in northern Spitsbergen, where Schröder-Stranz's ship was frozen up all winter Most of the German party, after the attempt to proceed overland to Advent Bay, had returned to the ship, but Detmers and Moeser were reported drowned, Eberhardt had been frozen to death, Stave had died of illness, Rüdiger the oceanographer, had been severely frost-bitten and had lost a foot, and no tidings had been received from Lieut. Schröder-Stranz and his three companions, who embarked on a sledge expedition last autumn

A Good Idea in Names.—Long-winded German names are something of a trial to the world at large, but the Germans themselves appear to have found the remedy In 1909 an international aeronautical exposition was organized at Frankfort-on-the-Main. Its full name in German was "Internationale Luftschiffahrt-Ausstellung" After being abbreviated to "I L A," this ultimately became "Ila," and as the "Ila" the exposition has since been universally known In like manner the "Allgemeine Luftfahrzeug-Ausstellung" held last year in Berlin was known as the "Ala," and now we hear of the "Damnu," which, to the busy man, is a happy substitute for "Deutsche Ausschuss für den mathematischen und naturwissenschaftlichen Unterricht." "Imuk," which signifies Internationale mathematische Unterrichts-Kommission, and "Datsch," a condensation of Deutsche Ausschuss für technische Schulen. Of course, this method of syncopation has its limits; since many combinations of initials are unpronounceable, while others might be too grotesque to be palatable. On the other hand, it seems likely that in future the names of many expositions, societies, and the like will be deliberately selected with reference to such abbreviation.

Aeronautics

A Medal for Capt. Chambers.—Capt. W. I. Chambers, head of the aeronautical department of the navy, was presented with a gold medal recently by the Aeronautical Society This honor was awarded because he was the first to demonstrate the use of the aeroplane as an auxiliary to the navy. Capt. Chambers' apparatus has been described and illustrated in the columns of the SCIENTIFIC AMERICAN

Counteracting the Cyclonic Action of Air —In a patent, No 1,060,273, Chester B Molott of Yonkers, N Y, has patented an aeronautical apparatus which has supporting and controlling surfaces with propelling means whose axis is parallel to the line of flight Some of the surfaces extend radially from the said axis and adjacent to the propelling means so as to resist the cyclonic action of the air set in motion thereby, and means are provided for adjusting some of the radial surfaces substantially around the axis.

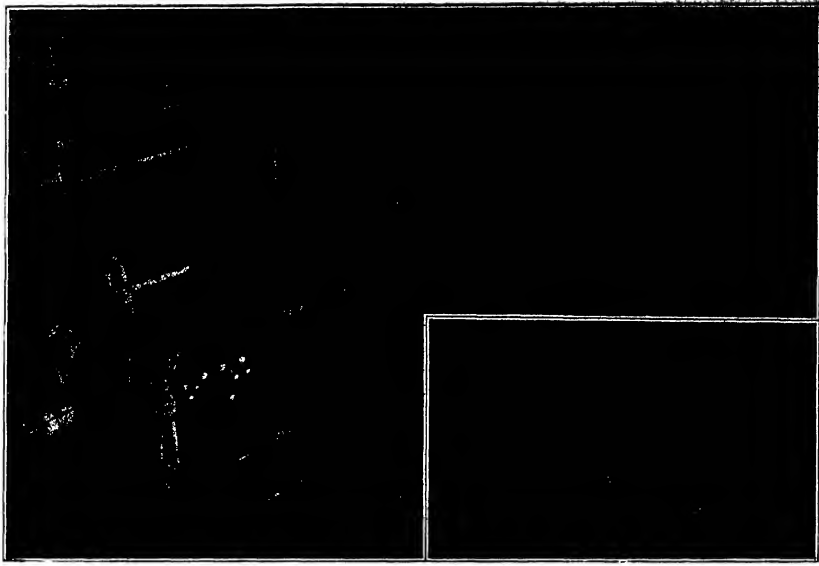
System of Aeroplane Control —A patent No 1,058,422, is issued to Edson F Gallaudet of Norwich, Conn in which the main supporting wing surfaces of an aeroplane are provided with auxiliary surfaces which are mounted forward and aft at or near the tips of the wing surfaces, and these auxiliary surfaces are actuated differentially to change the relative areas of the front and rear sections of the wing surfaces by projecting the auxiliary surfaces either forwardly beyond the entering edge or backwardly beyond the trailing edge of the wing surface

Antarctic Coal —According to Prof D W Edgeworth David, of the University of Sydney, Australia, the deposits of coal discovered by the Shackelton and Scott expeditions in the Antarctic will perhaps prove to be one of the largest unworked coal fields in the world Wild of the Shackelton expedition, discovered seven seams of coal outcropping in a great cliff face of sandstone and shale. The thickness of these seams inclusive of a few clay bands, was 7 feet Specimens chopped out by Wild with his ice ax have been analyzed at Sydney and show the coal to be of workable quality Scott's geologists traced this field for a distance of 650 miles extending northward from the head of the Beardmore Glacier

Balancing Devices for Aeroplanes —In a patent, No 1,058,712, to Ashley C Bennett of Minneapolis Minn, assignor of one half to Ralph D Wilcox of Minneapolis, is shown in connection with the lifting plane of an aeroplane, balancing planes arranged at the outer ends of the lifting plane and in pairs, one in advance of the other, and arranged to be projected alternately laterally beyond the lifting plane, the forward ones of the balancing planes having depressing effect and the rear balancing planes having an elevating effect and those balancing planes are connected with each other, so that when one set of balancing planes is operated the other set will be actuated also

The French Chamber recently voted a credit which is to be used for adding to the apparatus of the St Cyr Aerotechnic Institute, near Paris this establishment forming part of the University The committee decided that the amount should be used for constructing a dynamometric balance of large size for mounting upon the electric car which runs upon the track in the grounds for testing aeroplane surfaces, so as to allow an entire aeroplane to be used upon the car In the second place, the round building and its experimental track is to be fitted with an electric-motor apparatus placed upon a central pivot so as to rotate objects around the track in order to study the resistance of the air, such as models of surfaces or helices By means of the electric outfit variations of speed can be easily made A large air blast apparatus is also to be installed for testing small models in a fixed position in a strong air current which can run as high as 90 miles an hour The first two apparatus will be installed so as to be at work during the coming visit of the Senate aviation commission

The Aeroplane Industry in Germany - The *Berliner Tageblatt* gives the following *résumé* of the situation of aeroplane manufacture in Germany and from this it appears that matters are far from being in a flourishing condition, at least from a financial standpoint. At present there are thirty-five aeroplane construction works not counting amateur construction but in nine out of ten cases the orders come from the government and only go to two or three leading firms. In fact, the pilot officers are only trained to use two or three systems of aeroplanes, and it is not considered practical in time of war to use too many kinds of flyers. On the other hand, it was hoped that an extensive market would be secured by the proposed founding of aeroplane posts in the colonies, but this promise is not likely to be fulfilled at present. The constructors also expected much from the national aviation funds and the recently demanded credits for aeroplane work, but it appears that the distribution of the funds ruined their hopes, at least in part A few of the leading factories still continue to absorb the orders for aeroplanes. The journal concludes that in its *ensemble*, at least, the situation of the German aeroplane industry is in a very critical state.



Föttinger transformer of ten thousand horse-power for ship propulsion installed on the Vulcan-Werke's testing floor with steam turbine and Föttinger brake. The insert shows the rotor of a ten thousand horse-power hydraulic transformer for marine service.

Tests on a 10,000 Horse-power Föttinger Transformer

Hydraulic Gear for Marine Turbines

By Dr. Alfred Gradenwitz

IT will be remembered that the Föttinger transformer is an hydraulical transmission gear intended to transmit loads up to the highest figures from a motor shaft to another shaft coaxial with the former It can be designed for an equal number of turns of both shafts or for transformation into lower or higher speeds, for the same or an opposite direction of rotation, and it thus constitutes a reversing gear which allows the driven shaft to be reversed while the driving shaft continues working as before The principle of transmission can be briefly described as follows: A rotor mounted on the primary shaft is designed as a high grade centrifugal pump, lifting water which in the water wheels mounted on the secondary shaft, works under similar conditions as in hydraulic turbines. By a skillful combination of these wheels, Dr Föttinger has produced a compact gearing of remarkable safety in operation and satisfactory life, in connection with which any losses due to hydrodynamical transmission are reduced to a minimum

In view of these special features of the Föttinger transformer and the advantages it shares with all hydraulical machines, it is especially adapted to serve as an intermediate gearing on board ship, between the steam turbine and the propeller It is well known that the economical speed for marine steam turbines is much higher than that desirable for the propellers driven by the turbines. The interposition of the transformer between the turbines and the propellers enables both to be driven at the speed which gives for each the highest economy

Interesting tests were recently made on the testing floor of the Hamburg turbine factory of the Vulcan-Werke, which were intended to demonstrate the suitability of the Föttinger transformer for the very largest outputs. A reversible transformer of 7,800 horse-power normal output, intended for the propulsion of a large transatlantic steamer of one of the big German shipping companies, was submitted to a continuous test of 14 days' duration, at high loads (5,000 to 10,000 horse-power) The arrangement of these tests was as follows

A steam turbine of the Curtis-A. E. G.-Vulcan system was installed on the testing floor, the primary of the transformer being coupled to the turbine. The secondary energy was braked by a large hydrodynamical Föttinger brake designed for a maximum output of 15,000 horse-power, the propeller thrust being replaced by an hydraulical axial thrust so that the transformer was actually operated under the same conditions as it will eventually be in the vessel. Between the driving turbine and the transformer on one hand and the transformer and the brake on the other were inserted torsion gages for determining the primary output and checking the secondary output as indicated by the brake. The normal output of the transformer corresponds to 800 revolutions per minute of the primary shaft and 160 revolutions per minute of the secondary shaft.

These tests have shown the efficiency of the transformer to be up to 90 per cent. The transformer was found to work with absolute smoothness, without any vibration or noise, reversals being effected with astounding rapidity and safety The speed of rotation of the turbine, even during reversals, was kept permanently within given limits by means of a centrifugal governor. It may be as well in this con-

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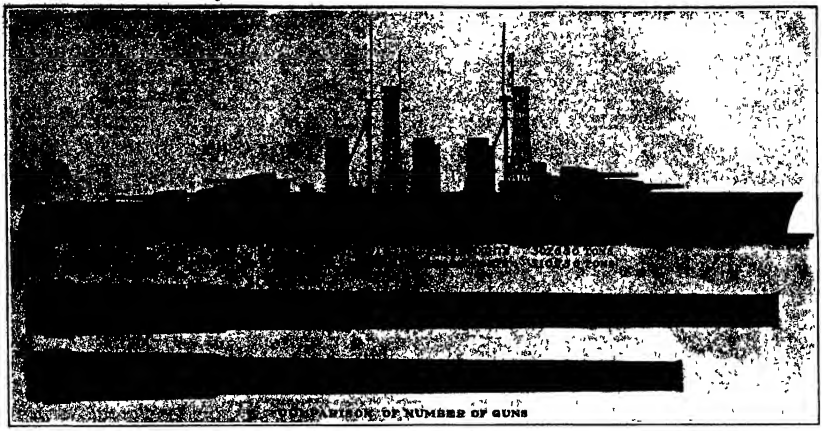
General view of a ten thousand horse-power Föttinger transformer for ship propulsion.



Graphic comparison of Japanese and American dreadnoughts and their armaments.

The Japanese and American Navies Compared

How Japan is Outstripping America

By Percival Hislam

At this moment the principal Japanese warships in service are the battleships "Satsuma" and "Aki" and "Kawachi" and "Settsu." The first two, though not dreadnoughts in the strict sense of the word, are certainly entitled to rank as such. The "Satsuma" displaces 19,350 tons and carries four 12-inch, twelve 10-inch, and twelve 4.7-inch guns, while the "Aki" displaces 19,800 tons and has eight 6-inch in place of the 4.7-inch weapons. The other two ships are typical dreadnoughts, displacing 20,800 tons and carrying twelve 12-inch guns apiece. In addition to these ships the battle-cruiser "Kongo" has just completed her trials after construction in England by the Vickers firm. She is a ship of 27,500 tons, with a designed speed of 27 knots, and is armed with eight 14-inch and sixteen 6-inch guns. The significance of the fact that Japan has a ship with 14-inch guns completed several months before the *New York* and "Texas" are due to be completed, ought not to be overlooked.

Besides these ships, Japan has actually under construction the battle-cruisers "Haruna," "Hiyei" and "Kirishima," and the battleship "Fuso." The first three are sister ships to the "Kongo," and the "Fuso," although her details have not been officially published, is understood to have a displacement of 30,000 tons and to carry an armament of ten 15-inch guns. These four ships are all building in Japan—a fact which itself speaks volumes for the progress made by that nation in recent years. Not one of the battleships or armored cruisers that took part in the campaign against Russia less than ten years ago was native-built, but since then Japanese yards have completed four battleships averaging 20,000 tons, and four armored cruisers, of which two displace 13,750 tons and two 14,600. It is true that a good deal of the material used in the construction of these ships was imported, but the percentage of imported material has diminished considerably. For the battleship "Satsuma," completed in 1910, 61 per cent of the material was imported, but for the "Kawachi," completed in 1912, only 20 per cent. This means that Japan is rapidly becoming a self-contained nation so far as naval construction is concerned.

During the past few weeks three more battleships have been ordered—all in Japan. One is to be built at Yokosuka (dockyard), one by the Mitsubishi Company (Nagasaki), and one by the Kawasaki Dock Company (Kobe). In bringing the new programme before the Lower House, Admiral Takarabe, "Vice Minister of Marine," stated that the original scheme prepared by the Navy Department provided for the construction of 8 battleships, 8 battle-cruisers, 16 scout-cruisers and 40 destroyers. This, however, would have cost $270,000,000, and the finances of the country were not in a position to stand such an outlay, and it had therefore been decided to reduce the programme to 8 battleships, 4 battle-cruisers, 8 scout-cruisers and 40 destroyers. It was definitely stated that this did not include the ships at present under construction, and that the total cost was estimated at $190,300,000. As a preliminary step toward the execution of this scheme it had been decided to lay down three battleships at once, and these are the sister ships to the "Fuso," referred to at the beginning of this paragraph.

Reckoning as dreadnoughts the battleships "Satsuma and "Aki," the present dreadnought strength of the Japanese navy is five ships completed and seven under construction or on order. The corresponding totals for the United States are eight ships completed and five on order, giving a numerical superiority of 13 to 12 in favor of the United States. This is admittedly backed up by a great advantage in "pre-dreadnought" ships, but these are quickly dropping out of the scale of naval power, and no nation that looks a yard in front of its own nose will be deluded into placing more reliance upon them than they are really worth. The future, so far as the eye can see it with any certainty, is with dreadnoughts, and of dreadnoughts the United States has 13 ships built and building to Japan's 12.

Examining these totals more closely, the position is not so favorable as even this niggardly margin would indicate. The following table gives the tonnage of the vessels concerned:

UNITED STATES. Ships.	Tons.	JAPAN Ships.	Tons.
2 Michigans	32,000	2 Satsumas	39,150
2 Delawares	40,000	2 Kawachis	41,600
2 Floridas	43,650	4 Kongos	110 000
2 Wyomings	52,000	4 Fusos	120,000
2 New Yorks	54,000		
2 Nevadas	55,000		
1 Pennsylvania.	31,000		
13 Dreadnoughts	307,650	12 Dreadnoughts	310,750

So far as tonnage is concerned—and tonnage is usually reckoned as expressing fighting power in one form or another—the twelve Japanese dreadnoughts built and building are therefore superior to the thirteen of the United States. In comparing gun-power the figures are naturally more complicated, but if the statement, generally accepted, is right which credits the Japanese "Fuso" class with ten 15-inch guns, the comparison as regards the dreadnoughts tabulated above is as follows:

Caliber	United States		Japan	
15-inch		132	40	128
14-inch	52		32	
12-inch	80		32	
10-inch			24	
6-inch		208	156	188
5-inch	208			
4.7-inch			32	

Among the Japanese guns, the projectile of the 15-inch weighs 1,950 pounds, of the 14-inch 1 400 pounds, of the 12-inch, 850 pounds, of the 10-inch, 500 pounds, of the 6-inch, 100 pounds, and of the 4.7-inch, 45 pounds. Measuring gun power on the basis of one round fired from each gun, it will be found that the Japanese dreadnoughts are superior to the American by 179,040 pounds of metal to 154,880 pounds. Measured by the usual scale of dreadnought comparisons, this indicates a Japanese superiority in gun power of 15 per cent, in spite of an inferiority, small though it be, of 12 ships to 13.

What is a Dendrologist?

Dendrologist is the name applied to one who is engaged in the study of tree botany or dendrology, which is derived from the Greek words *dendron*, tree and *logos*, discourse, a treatise on trees. Dendrology may thus be defined as a branch of botany that treats of trees, which properly includes taxonomy, morphology, anatomy, physiology and ecology of tree species. While dendrology is a division of botany, it is far more specialized and includes a knowledge of plant life, which is seldom considered to be a part of systematic botany. One who knows botany in a general way is not necessarily a forester, but the dendrologist who has specialized in all phases of the scientific knowledge of trees, including a study of the factors which influence the life and growth of trees in their natural or adopted habitat, possesses the requisite training of a forester. A thorough knowledge of the life history of trees formed the basis for all silvicultural operations which are naturally included within the sphere of dendrological studies. The word dendrologist originated in England in the seventeenth century, and was probably used first by Evelyn in order to designate definitely the expert engaged in the study of tree botany and dendrology in order to designate the work itself.

Mining the Air with Balloon Torpedoes

By Major H. Bannerman-Phillips

THE delivery of the "First Wilbur Wright Memorial Lecture" at the Royal United Service Institution by Mr Horace Darwin, before the members and guests of the Aeronautical Society, reminds both sailors and soldiers that it was the great American investigator, indefatigable pioneer, and skilled constructor and aviator, who, in conjunction with his brother Orville, first took flying out of the dreams of fancy and made it a living fact. It was inevitable that their peaceful conquest of the air should lead to its immediate utilization for purposes of war We must face the possibility of fresh methods of warfare superadded to those with which we are already acquainted. How will these affect the attack of fortified places, more especially sea ports and naval war harbors?

In considering the problem of injuring coast defenses, and arsenals or storehouses containing material for refitting war-vessels, the first question which occurs to the mind is the possibility of damage by bombardment, and the shortest range to which the attacking ships can approach in order to use their guns with effect. The second is the chance that may exist of inflicting blows on such nerve-centers of the defense as, on account of their affecting the control of the defender's artillery fire or his supply of ammunition, it may be important to paralyze, if possible, as a preliminary to a more general attack.

We may infer, from the experiences of the Russo-Japanese war and from the more recent sinking of merchant vessels in Smyrna harbor—the aftermath of mine-laying during the Turko-Italian and Turko-Balkan wars—that until the sweepers and creepers of an attacking fleet have thoroughly gone over the mine-field which will cover every coastal defense of any importance, the large ships will have to move with extreme caution, and at great risk if they want to get within range of the enemy's defenses. The development of the steerable automobile torpedo with its long range, is another question to be considered by the hostile fleet, for the local torpedo flotilla, and the submarines by day and destroyers by night, will be constantly on the lookout for the enemy's warships. Even as recently as the Russo-Japanese war the long range torpedo had not to be very seriously reckoned with, but now it has become a potent factor

This being so, and since an attacking fleet will have, during the initial operations at any rate, to keep at a safe distance from properly equipped harbor defenses, there will be every reason for commanders to use the air as a means of first reconnoitering, and secondly endeavoring to cripple the defenses on shore by the demolition of nerve-centers, the destruction of arsenals, setting fire to store-houses and oil tanks, and creating a depressing moral effect on the garrison.

It has been suggested that fortified places might be protected by a system of aerial mines in captive balloons to prevent airships from getting vertically over the guarded area, these being exploded either by electricity from below, or in consequence of being fouled by the attacking dirigible in its endeavor to place itself in the required position for dropping explosives.

This is the old, and inefficient, method of *passive* defense. The range of modern special airship destroying artillery is far greater than the height attainable by a dirigible, but supposing 5,000 to 6,000 feet to be a safe altitude from artillery, the object of the "mine" (captive balloon) would be to cause danger at a still higher altitude Putting the weight of cable at 70 pounds for every 1,000 feet, it will be seen that 6,000 feet of cable would weigh 420 pounds, so that the balloon would have to lift this plus the weight of envelope, car and explosives. The weight of a captive balloon of 10,000 cubic feet capacity complete is about 250 pounds, and its lifting capacity, filled with hydrogen, is 700 pounds, or with coal gas, 375 pounds, and coal gas would preferably be used for "mine" balloons on account of the great expense of hydrogen The weight to be lifted would therefore be 420 + 250 = 670 pounds, without allowing for the explosives, but at a height of 6,000 feet above mean sea-level, the lifting power of the hydrogen would be reduced to 540 pounds, because the volume of air which it displaces, although the same at that altitude, is lighter and the lifting power of the gas is the difference between its own weight and that of the equal volume of the surrounding air Therefore the captive balloon could not carry its own weight and its cable to the height of 6,000 feet, without taking into consideration the occasional increase in weight from moisture deposited by rain or dew on the envelope, which might amount to another 100 pounds.

In a fog or at night an enemy's airship, moving without searchlights for concealment, might run foul of one of the captive "mine-balloons" in endeavoring to get vertically above the protected area, but by daylight and in clear weather, and if undeterred by the presence of mobile aircraft guarding the defenses, it could fly round the area at a safe distance and destroy the mines" by fire from its machine-guns, or by aerial torpedoes of the Unge type, worked by compressed air; the explosives carried by the mines would, if not exploded by the fire of the airship, fall upon and damage the buildings, etc., which they were intended to guard.

A high wind, or a sudden storm gust, might cause the same effect, and lightning might explode the balloon and cause the descent of the explosives with similar results, although the balloon could be connected electrically with the earth by way of protection.

If the "mine-balloons" were stationed close enough to one another to form a defensive *enceinte* or network, the wind might cause the cables to foul one another and get entangled. It does not take much wind to cause the cable of a captive balloon to assume a considerable angle with the vertical, and the farther the balloon is carried down wind, the more the cable slopes from the balloon to the ground. In a strong wind, unless the surplus "lift" of the gas is very great, the balloon is brought close to the ground and cannot rise to any height. The greater the "lift," the higher it will rise, but to obtain this, the size of the balloon must be large in proportion to the weight it has to raise, and the surface it presents to the wind and consequent difficulty in rising are increased accordingly

On the whole, it would be more profitable to trust to the airship-destroying artillery armament of a fortress for local defense and expend the funds which would otherwise be devoted to captive balloons and explosives on strengthening the *mobile* aerial equipment, in other words, meet the menace of aircraft with still better aircraft, which could either deal with the enemy's dirigibles before they reached the guarded area, or sally out, pursue and attack them by machine-gun fire, if they came over by surprise The moral effect of the possession of a superiority of aerial cruisers would do more to check reconnaissance and attack than the most elaborate preparations for passive defense

The Langley Aerodynamical Laboratory

By Carl Hawes Butman

THE establishment of the Langley Aerodynamical Laboratory is a fitting and live tribute to him who contributed so much toward the solution of the problem of mechanical flight

The laboratory is under the Smithsonian Institution, and its object is to study the problems in aerodynamics, with such research and experimentation as may be necessary to increase the safety and effectiveness of aerial locomotion for the purpose of commerce, national defense, and the welfare of man

The laboratory was authorized by the Board of Regents at a meeting on May 1st, 1913, called especially for the report of a committee previously appointed for the consideration of this matter

The laboratory is to be under regulations to be established, and fees to be fixed by the chairman of the General Committee, with the approval of the Executive Committee of the Board of Regents. It may exercise its functions for the military and civil departments of the Government, as well as for any individual, firm, association, or corporation in the United States, provided such department, individual, firm, association, or corporation shall defray all the expenses accruing from any such services rendered by the exercise of the functions of the laboratory Bulletins and other publications for public distribution, containing such information as may be valuable to the Government or the public, will be issued from time to time These publications will include an annual report which will cover the work of the laboratory and the researches of the general and sub-committees.

It was deemed advisable to have the work divided up into several departments, and members of the General Committee were designated as chairmen of several sub-committees, the exact names, functions and personnel of which have not yet been determined.

The General Committee, it is understood, will take charge in an advisory manner of all aeronautical research, experimentation and additional laboratories in which the Government may become interested or foster; in this way, it will be a general advisory committee on aeronautics. Its functions will be numerous and its scope national.

An office in the Smithsonian Building has been made available by the secretary, Dr Alfred Zahm has taken up the office work of recorder, and is planning the publication of a hand-book intended to show the scope and functions of the committee in general, and the laboratory in particular

The project has been financed by the Board of Regents through an appropriation of $10,000 for the present year, and $5,000 annually for five successive years.

A valuable adjunct to the office of the committee is the library relating to aeronautics, already located in the Smithsonian Building. For several years Mr. Paul Brockett, assistant librarian of the Institution, has been collecting publications, especially periodicals, relating to aeronautics, and these have been added to the volumes and pamphlets brought together by the late secretary, making a very good reference library now available.

It is an odd but happy circumstance that the Government is now, although indirectly, to promote aviation and the study of aeronautics after ten years of inactivity, and that the branch of it to carry on the work is that whose secretary previously undertook the now historical experiments which, after incurring an unfortunate accident, and receiving much public ridicule, were terminated by the Government, which thereby lost an opportunity for international leadership in aeronautics. It is hoped that now the United States will pursue what investigations and experiments are undertaken by the committee, in the Langley laboratory or elsewhere, and in no event relax its interest or neglect opportunities for the national development of aeronautics.

"The Mysterious Problem"

By Clarence T. Hubbard

THE following combination of two old principles makes a pleasing conjuring experiment for parlor presentation. It is very simple in operation, requires no skill to speak of, yet with appropriate "patter" it makes an astonishing effect. The method found most satisfactory is as follows The performer displays a large sheet of white paper, calling attention to the fact that it contains no writing or marking of any kind. This is suspended from a frame or rested against an easel in full view of the spectators. Then the entertainer addresses the audience and requests them to think of a number This being done, they are asked to multiply the number thought of by 2. The next step in the process is to add 6 and to then divide the result thus obtained by 2. Next, direct them to subtract the number originally thought of and to add 4 to the final result. The conjurer then applies a match to the paper, which is seen to burn up with the exception of a strip that resembles the figure 7 very distinctly Seven proves to be the answer to everybody's problem regardless of the fact that each person thought of a different number to begin with. To obtain the effect with the paper the reader must add a few drops of nitric acid to a sufficient quantity of asbestos paint and with a brush outline the figure on the paper and allow it to dry This, of course, must be done prior to giving the exhibition. Seven will always be the answer if the above formula is employed. A little talk relative to the peculiar properties of the figure seven would add to the amusement of the trick. Try it.

The Current Supplement

IN this week's issue of our SUPPLEMENT Sidney Low discusses the question "Is Our Civilization Dying?" It is difficult to fix beyond doubt the causes of the decline of great empires. Were they physiological? Or was moral corruption the principal cause? These and many other questions Mr Low seeks to answer—A tragic balloon accident, presenting very unusual features, recently occurred near Paris. An illustrated description of the facts known is reproduced from French sources.—Chester L. Lucas describes the manufacture of steel type, such as is used, for example, for stamping metal articles.—Prof. Hilbert endeavors to gage the length of geological epochs on the basis of radioactive phenomena.—Prof Charles L. Parsons gives a comprehensive review of the present situation as regards occurrence and extraction of uranium and radium ores in this country and abroad.—E. V Heward, in an article entitled "Glimpses of the Moon," discusses some of the most interesting problems which the nearest of all heavenly bodies presents to us. Are the volcanoes on the moon still active? Is there vegetation on our satellite? These are questions which some astronomers are disposed to answer with yes.—D. A. Lyon writes on the use of the electric furnace in the production of iron from the ore.—An article on "Ugly Fishes" presents to the readers some remarkable vagaries of nature in the fish world.—The article by A. J. Lotka on "Evolution From the Standpoint of Physics" is concluded in this issue.

What is the Minimum Lung Capacity?

USING what is known as the pneumo-thorax method, Bernard and Le Play showed in France that the minimum lung capacity which is compatible with life may be estimated at one sixth of the normal capacity. J Courmont, in his experiments which he has been carrying on for a number of years, reaches similar conclusions by the use of a different method. He removes portions of the lungs of animals such as rabbits or dogs, and finds that these animals are able to live for several months after the ablation of three quarters of their lungs. In addition to this, he believes that the entire removal of one of the lungs is followed by a slight compensating hypertrophy of the remaining lung, together with [illegible]

A Project to Raise Decatur's Frigate the "Philadelphia"

By H. C. Plummer

AFTER almost one hundred and ten years' rest in the sands at the bottom of the Libian Sea, the gallant United States frigate "Philadelphia," once the "terror of the sea," will be raised and brought to America, if legislation soon to be introduced in Congress by Representative J Hampton Moore of Pennsylvania is approved. The wreck of the old Yankee man-o'-war lies directly in the path of a system of harbor improvements at Tripoli that are contemplated by the Italian Government. These comprise the building of railway terminal, warehouses and docks and the erection of permanent steel hangars for the dirigibles and aeroplanes used by the Italian army forces for reaching the wild desert interior of Fezzan, which is exceedingly difficult of access by land.

The movement to bring to the surface and to transport across seas to this country the "Philadelphia," which was started by an American war correspondent, Harold Sherwood Spencer, after the close of the late Italo-Turkish conflict, has made a distinct appeal to the patriotic and romantic sentiments of the Italian people. "A glorious page from American history rises from the bottom of the Libian sea" is the headline of an editorial upon the subject which recently appeared in *La Nuova Italia* (*The New Italy*), the daily newspaper of Tripoli and organ of the military administration of Tripolitania. The article reviews in eloquent terms the gallantry of Lieut. Stephen Decatur, who, more than a century ago, boarded the captured "Philadelphia" with sixty men and officers and, "within half gunshot of the Bashaw's castle," succeeded in burning and sinking the frigate and in effecting the escape of himself and his company of three-score to the ketch "Intrepid." He had been assigned to his perilous task by Commodore Edward Preble, commanding the United States ship "Constitution," at anchor in the harbor of Syracuse, on the southern coast of Sicily, opposite to Tripoli.

Through the efforts of the American consul-general at Tripoli, John Q. Wood, permission for the raising of the wreck has been granted by Governor General Ragni, who personally aided a technical investigation lately conducted at the scene by Lieut. Richard Drace White, naval *attaché* of the American embassy at Rome. This investigation was further assisted by William S. Riley, an Englishman who has been a resident of Tripoli for twenty five years and who has manifested a lively interest in the recovery of the one time defender of American commerce on the high seas.

An appropriation of $15,000 is sought for the bringing to the surface of the "Philadelphia" and her conveyance through the Mediterranean and across the Atlantic to this country The wreck lies in about 15 feet of water directly off the Spanish fort at Tripoli and near a breakwater and lighthouse constructed by the Italian government as one of the earliest improvements of the Barbary port wrested from Ottoman dominion

Divers who were employed by Lieut. White reported the whole wreck to be imbedded in sand in the form of a mound, which slopes off in all directions. They sawed off portions and found the planking covered with copper in a state of partial decomposition and also found the remains of nails so corroded that they are nothing but hardened rust.

In his report to the Director of Naval Intelligence at Washington, the naval *attaché* stated

"When Mr Spencer suggested raising her, he was of the opinion that the ship rested on an approximately even keel and did not extend deep into the sand, and his idea was that she could be scooped out and lifted with shears and put on shore intact. It appears that she lies on her side (thought to be starboard, though this is uncertain), her keel in a line approximately northeast and southwest. She is entirely covered by sand, except for a portion approximately 35 feet in length on the above-mentioned bearing and 15 feet in width, in which space portions are visible in places projecting above the sand bottom in some cases as much as 1½ feet.

"There are three or four projections visible, which appear to be ribs or frames of the hull. These appear to curve upward, which leads me to believe that they are situated near the bow or the stern. This is, however, only a surmise, as the curvature may only be apparent. There are several planks which extend in a northeasterly direction and end abruptly Beyond their end is a rectangular piece lying at right angles to the lengthwise direction of the planks.

"The divers who made the examination; the engineer in charge of the divers, Mr Spencer, Mr. Riley, the American consul, Mr John Q. Wood, and I are agreed in the opinion that the part visible is the remains of the ribs and skin of the ship. The planking which ends so abruptly we believe to have sprung loose, or pulled loose, from the frames, and to have straightened out more or less. We conclude that the ship sunk on the original bottom of the harbor, which slopes away abruptly to the northeast, with one end much lower than the other, and that the sand which now covers her has [illegible] in, making the harbor at this point much shallower than it was at the time she sank.

"[illegible] that the ship was [illegible] feet in beam and 200 feet [illegible] in the sand to a depth of approximately [illegible] feet, and for a length of approximately 200 [illegible]

"It is believed that the best way to attempt to raise her is to dredge around her and inside her as much as practicable and then raise her with floats and chains, if practicable, intact; otherwise, in sections cut adrift before being lifted.

"In this connection the lack of facilities available at Tripoli for work of this character has been considered. There is a small floating crane of 75 (I am told) tons capacity There are some small lighters, there are some small cranes on shore. That is practically all."

The Ditta Amalgiá, an Italian engineering firm which has the contract for the commission of the improvements planned by the royal government, provided Lieut. White an estimate of $12,000 for the raising of the "Philadelphia" and the placing of her on the beach at Tripoli.

The American *attaché* thus concludes his report

"The project is to raise her intact, but this may become impracticable, in which case it would be necessary to raise her piece by piece. Their estimate is based on the assumption that there would be 4,000 cubic meters to excavate, at a cost of $2.50 per cubic meter, and that the cost of raising her and putting her ashore would be $2,000. They also estimate that they could raise a section of 45 feet length along the part now projecting above the water for $5,000 And I am of the opinion that for $2,000 that part projecting above the bottom and a considerable portion adjacent thereto could be raised.

"In addition to the cost above enumerated there would be the cost of conveying the material recovered to the United States."

From the date of her launching at Philadelphia, November 28th, 1799, until the hour of her ignominious capture by the Tripolitans, October 31st, 1803, the frigate which it is now sought to recover and to preserve to posterity, maintained a glorious record for the Stars and Stripes and the young navy of the American republic. She was the flagship of a squadron of thirteen vessels under command of Capt. Stephen Decatur senior, on a cruise to the West Indies in 1800, in which she effected the capture of five vessels from the French

She sailed from Philadelphia on her third and last cruise, commanded by Capt. William Bainbridge July 28th, 1803, and on August 26th, 1803, shortly after she had reached the Mediterranean, she captured, near Cape de Gatt, the Tripolitan ship "Meshboka" or "Mirboka," and recaptured from her the American brig "Cecilia" of Boston

The American Road Congress

THE American Road Congress will hold its third annual meeting at Detroit during the week of September 29th. This decision was reached by the joint committee of which Logan Waller Page, director of the United States Office of Public Roads, is chairman after a spirited contest which finally narrowed down to the cities of St. Louis, Denver, Minneapolis, and Detroit. The congress is the great annual assemblage of the good roads organizations throughout the United States, and is held under the auspices of the American Highway Association, the American Automobile Association and the National Association of Road Machinery and Material Manufacturers, the latter organization being concerned primarily with the exposition of machinery and materials held in conjunction with the congress.

As there are between thirty and forty State and inter state organizations identified with the American Highway Association in addition to its 1,800 regular members, the big meeting will be thoroughly representative in character

Arrangements have just been made to hold the annual meeting of the Michigan State Good Roads Association which has 15,000 members, the newly organized Michigan Trunk Line Association, and the Ontario Good Roads Association, in conjunction with the congress. The combined attendance of these various road organizations will be well over 5,000 and will certainly set a new record far in advance of attendance figures at any previous good roads meeting in the United States.

The foremost engineers and contractors will join with distinguished laymen in making the programme complete and effective. The sessions will be arranged as heretofore so as to specialize on construction main tenance, legislation, administration, economics, etc. It has been decided to have a special session for the benefit of contractors, and in order to make this session of practical value to the contractor, a committee composed of some of the best informed men on contract work in this country will have full charge of preparing the programme and conducting the session.

The exposition will be held on the ground floor of the Wayne Gardens immediately under the large hall in which the sessions of the congress will be held, and in order to meet the requirements of the companies which manufacture heavy road building machinery, a large vacant lot and an adjoining street will be transformed into exhibit space by the erection of a large tent in which heavy machinery may be exhibited and demonstrated. As heretofore, the remarkable Government exhibit of road models will be a feature of the exposition together with the various State exhibits which will be shown in much larger number than at the congress held in Atlantic City in 1912.

The officers of the congress are Logan Waller Page, director of the United States Office of Public Roads, president, Lee McClung, former Treasurer of the United States, treasurer, J E. Pennypacker, secretary of the American Highway Association, secretary, and Charles P Light, former State Highway Commissioner of West Virginia, assistant to the president. The headquarters of the congress are in the Colorado Building, Washington, D C

Exhibition of Improved Talking Pictures and Moving Pictures in Natural Colors

ON the 5th instant there was given in the Thirty ninth Street Theater in New York city, by arrangement with Mr Frederick C Beach of this journal, two demonstration performances of talking pictures and moving pictures in natural colors as perfected by M. Leon Gaumont of Paris, France.

As early as November 17th 1902, M Gaumont gave a demonstration before the French Photographic Society of talking moving pictures, in which there was complete synchronism between the phonograph and the cinematograph These records were made simultaneously

Besides talking pictures, M Gaumont has been working for some time at the problem of producing moving pictures in natural colors. About a year ago he succeeded in accomplishing this in a simple and direct manner

The method of obtaining these pictures is that used in the well known three color process, viz. the making of three separate negatives through transparent color filters of the three primary colors and the projecting of the corresponding positives through their three respective color filters in superposition and accurate register upon the screen The rate of projection of the pictures is as usual sixteen per second, they being arranged in groups of three on the film, which is moved far enough each time to bring another group before the triple lenses.

The exhibition was opened with chronochrome pictures of flowers in vases on a revolving table, followed by outdoor scenes The first picture showed the flowers in black and white but with a remarkable stereoscopic effect, the result of there being three distinct pictures superposed on the screen instead of but one. The second picture showed the same flowers in all their natural beauty, while the views that followed, depicting farm scenes in the south of France and glimpses along the Riviera were entrancing in their naturalness.

A photo play taken under artificial light was shown in which the colors of the costumes and decorations were perfectly rendered The facial expression of the actors was reproduced with a naturalness and softness that was wonderfully lifelike and there was nothing lacking in detail

There followed beautiful studies in nature of mounted specimens of butterflies in which the varying sheen on the wings when viewed from different angles was extremely beautiful Words can hardly express, too, the magnificent nacreous luster on some specimens of sea shells that were shown

The talking picture exhibition demonstrated the remarkable effectiveness of the electrical synchronism between the picture film and phonograph, the loudness of the sound of which is intensified by means of compressed air on the principle employed in the Parsons auxetophone

A talking motion picture play of twenty minutes duration was produced by a series of records rapidly changed from one to another, by a special device, until the close of the play Au amusing subject was a rooster standing on a pedestal, flapping its wings and crowing very naturally and vigorously

Another example was a lion tamer putting his lions through their tricks, which resulted in much naturalistic roaring by several of the beasts

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Piping Hydrogen for Airships.—A pipe-line for hydrogen is in successful operation between the electro-chemical works "Griesheim-Elektron" and the airship hangar in Frankfort-on-Main The line is 4½ kilometers long and to avoid the danger of leaking from non-tight joints it is welded autogenously throughout most of its length, the pipe being joined by unions only at long intervals One thousand cubic meters of gas per diem can easily be supplied, which requires a pressure of about 1 000 millimeters (water column) The pipe ends at the plant in a gas-tank of 6,000 cubic meters capacity The hydrogen passes thence into subterranean pipes in the hall (Halle) in whose cement floor are 18 shafts provided with gas-cocks which are connected by tubes with the separate compartments or cells of the airship The hydrogen is produced as a by-product in the electro-chemical manufacture of caustic soda and chlorine from sodium chloride in such large quantities that much of it still goes to waste in spite of the greatly increased demand for hydrogen This plant produces daily from 18,000 to 20,000 cubic meters of hydrogen, a sufficient quantity to entirely fill a Zeppelin.

Bacteriology and Your Health

Serums and Vaccines in the Diagnosis, Treatment and Prevention of Disease

By Dr Charles F. Boldan

IT has long been known that certain infectious diseases occur naturally only among some of the lower animals and do not attack man, while, conversely, others appear to attack only man. Moreover, we are all familiar with the fact that persons who have once had, say, measles, or scarlet fever, or small pox are thereafter safe from a second attack, or as it is usually expressed "are immune." Since little was known as to the real nature of the infectious diseases until about thirty years ago, it is easy to see how the discoveries of bacteriology in the eighties opened up a wonderful field for the medical investigator and although most of the fundamental researches concerning the nature of immunity against infectious diseases date back hardly more than fifteen to twenty years, much light has already been shed on many obscure problems of medicine and the promise of further substantial benefits to mankind is held out. True, the work of Jenner in the end of the eighteenth century taught us the value of vaccination against small pox, and Pasteur in 1881 demonstrated his method of successfully protecting animals against anthrax by injecting them with living weakened anthrax bacilli. Neither of these discoveries, however, important as they were, gave any real insight into the nature of immunity. The subject was really illuminated when Behring, in 1890, announced his discovery of diphtheria antitoxin.

But let us go back, for a moment, to the time of Pasteur, say to the late seventies of the last century. It was well known that individuals who had had one attack of a particular disease were thereafter practically safe from a second attack. In other words, they were *immune*. This form of immunity is well illustrated in scarlet fever, measles, small pox, yellow fever. Often it lasts throughout the lifetime of the individual, though there are exceptions. In studying this acquired immunity, Pasteur conceived the idea of artificially producing an attack of a given infection in order to protect the individual against another attack. He realised that it would be necessary so to control matters that the original attack should run a very mild course and not endanger the life of the individual. After considerable experimentation he found that this could be accomplished by artificially weakening the bacteria with which the original attack was produced. Subsequently Salmon and Smith, two American scientists, showed that it was not necessary to produce even a mild attack of the disease by the injection of living bacteria, but that the injection of dead bacteria would produce an immunity against that particular bacterial infection. This form of immunity, whether caused by a previous natural attack of the disease or artificially by the inoculation of bacteria, is always *strictly specific*, that is, the protection extends only to the particular disease which has previously occurred or whose germs have previously been injected. An attack of scarlet fever protects only against scarlet fever but not against measles; inoculating an individual with typhoid bacilli protects him only against typhoid fever but not against dysentery or plague or cholera.

When Behring announced his discovery of diphtheria antitoxin, a host of laboratory workers at once took up the study of the blood serum as affected by bacterial injections. At their head was Paul Ehrlich, and it is largely to his extraordinary genius that we owe our present knowledge of this intricate subject. As a result of these investigations it was found that in response to the invasion by pathogenic bacteria the body manufactures certain specific substances designed to *destroy* the invaders or to neutralize their poisonous products. These antagonistic substances are spoken of as antibodies. The important antibodies thus far known are (1) antitoxins, (2) bacteriolysins, (3) agglutinins, (4) opsonins, (5) precipitins, and (6) antiferments.

When an animal is injected with gradually increasing doses of diphtheria poison, it withstands doses of the poison after a time which would suffice to kill hundreds of animals not so treated. This was done by Behring, in 1890, who found that the blood serum of the treated animals contained something which neutralised the diphtheria poison and rendered it harmless. What could be more natural than to see whether this blood serum could be used to treat other animals previously injected with diphtheria poison? Behring found that the serum thus used was able to save the animals from death. The action of the substance in the serum which counteracted the effect of the poison proved to be exactly like that of an alkali on an acid, i. e., it neutralised the poison. It was therefore called an *antitoxin*. The antitoxic serum does not differ in appearance from that of a normal, untreated animal, and even when tested chemically, but little difference can be discovered between the two. In order, therefore, to recognise the presence of this antitoxin in the serum, and especially in order to measure its amount, we must test it in animals, and see how small a quantity of antitoxic serum will save an animal after injection with a certain amount of diphtheria poison. It may interest the reader to know that sometimes as little as 1/5,000 cubic centimeter suffices to save from death a guinea pig which has received ten fatal doses of diphtheria poison.

In the manufacture of diphtheria antitoxin sheep were first used as the source of the serum, but at the present time horses are almost entirely employed. They are easily managed, produce high grade antitoxic serum, and yield enormous quantities of serum if properly bled. The animals are injected subcutaneously, receiving at the first injection an amount of diphtheria poison sufficient to kill about five hundred guinea pigs. Using gradually larger and still larger doses, the injections of poison are repeated weekly or oftener for about three months, at which time the horse will be found to have manufactured considerable antitoxin. In order to obtain the antitoxin, the animal is bled by inserting a sterile, hollow needle into the jugular vein, about six or seven quarts of blood being collected at one bleeding. The vials, the stoppers, as indeed all the utensils used for holding the serum, must be absolutely sterile, and every possible precaution must be taken to avoid contamination of the serum. The blood having been carefully collected in sterile flasks is allowed to clot, which causes the clear, straw-colored serum to separate. This serum is drawn off and constitutes the antitoxin as it is used by physicians.

The success attending the use of diphtheria antitoxin is now so well recognised that I need not go into that phase of the subject. Suffice it to say that prior to the introduction of antitoxin the mortality from diphtheria was about five times what it now is. This is well shown in the chart on this page.

Unfortunately it has been found impossible, except in a few instances, to produce antitoxins, because very few bacteria secrete toxins like the diphtheria bacillus. Careful study of the blood serum has shown, however, that even though no antitoxin is produced, the injection of bacteria is often followed by the formation, by the injected animal body, of substances which kill and dissolve the invading bacteria. Thus, if an animal is injected with typhoid bacilli, the serum will kill enormous numbers of typhoid bacilli after a time, even in very small doses; tested against cholera bacilli or against any other bacteria, its destructive effect is merely that of normal serum from an untreated animal. When the action of the

In order to obtain the antitoxin of the inoculated animal a sterile, hollow needle is inserted into the jugular vein. About six or seven quarts of blood are thus collected. The serum is drawn off and constitutes the antitoxin used by the physician.

Much interest has been aroused during the past few years in studies in serum treatment, and much has been written about the marvelous success achieved by our army surgeons in preventing typhoid fever during the maneuvers by the use of typhoid vaccines. More recently the newspapers have been filled with accounts of Friedmann's alleged cure for tuberculosis by means of living tubercle bacilli. In order to give our readers an intelligent idea of the principles underlying these modern therapeutic methods, we have asked Dr Charles F Boldan, a well-known authority in this field, to prepare for us a clear account of this highly technical subject. For years on the scientific staff of the bacteriological research laboratory of the New York city health department, Dr Boldan has become widely known by numerous papers in scientific journals, and as the author of several text books dealing with the subject here discussed.—EDITOR.

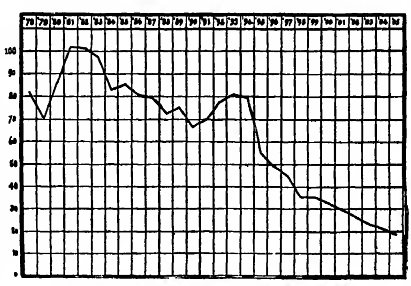


Chart showing the result of anti-toxin treatment in diphtheria.

The curve represents the death rate from diphtheria per 100,000 of population in nineteen large cities of the world. Note the rapid fall in the year 1895, following at once the introduction of anti-toxin treatment in that year

serum on the bacteria is studied under the microscope it is seen that the bacteria are actually dissolved. Hence such a serum is spoken of as a *bacteriolysin*, which means bacteria-dissolving. Since the bacteria are killed by this action, we also speak of the serum as being *bactericidal*, which means bacteria killing.

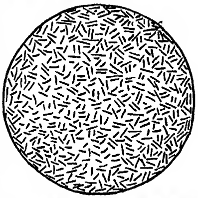
It has been found that this action of the serum may be developed against other cells than bacteria. When red blood cells are used, the serum acquires dissolving properties for these, and here again, the action is strictly specific, so that when blood cells from a chicken are injected into another animal, the serum of the injected animal acquires increased solvent powers only for chicken blood cells, but not for blood cells of other animals.

Investigation showed that the mode of action of those dissolving sera was somewhat complex and required the joint action of two different constituents. One of the constituents decomposes very easily, so that a serum which has stood several days may be found to have entirely lost its solvent power. This unstable constituent, however, is not peculiar to the serum of the treated animal, but is found in all fresh sera, even in those from normal, untreated animals. Hence it is possible to restore the solvent power to old, specific dissolving sera by the addition of a little fresh serum from a normal animal. This unstable constituent is spoken of as "complement." When using specific bacteriolytic sera therapeutically, we do not attempt to secure freshly-drawn serum, but rely on the complement present in the blood of every individual to supply the unstable constituent. For reasons largely still unknown, the use of many of these specific bacteriolytic sera for the cure of infectious diseases has been quite unsuccessful, and many difficulties still remain to be overcome. In some instances the fault seems to lie, not with the serum, but with the mode of its application. Thus, in the case of the serum for epidemic cerebro-spinal meningitis, the results first obtained were most discouraging, at that time the serum was given by means of subcutaneous injections. For some years past, however, the results have been uniformly good, the mortality being less than half that in cases treated without the serum. The serum is the same as before, but now it is always introduced directly into the spinal canal, where it can directly attack the invading bacteria.

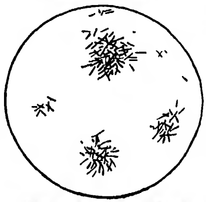
The researches of Metchnikoff showed that the white blood cells, or leucocytes as they are called, lay hold of and digest invading bacteria, and thus constitute an important means of defense against bacterial invasion. Subsequently, Sir Almroth Wright, a distinguished English physician, showed that certain substances present in the blood serum have the power of increasing the appetite, as it were, of the leucocytes, and, furthermore, that the amount of these substances can be increased by properly administered injections of the same bacteria it was desired to destroy. These substances in the blood serum he called *opsonins*. Wright devised an ingenious technique for measuring the opsonic power of the serum, using fresh human leucocytes, a suspension of the test bacteria, and serum from the patient. After allowing these to remain in contact for a given time he made microscopic preparations and noted the result. He compared this with a similar preparation made from the same leucocytes, the same bacterial suspension, but with serum from a normal individual instead of from the patient. He showed that before commencing treatment the patient's opsonic power was low, as evidenced by the small proportion of bacteria taken up by the leucocytes in comparison to those in the specimen with serum from the normal individual. With successful treatment with bacterial vaccines (see below), he caused the opsonic power to rise, as shown by the increasing proportion of bacteria taken up by the leucocytes, and with the cure of the infection he caused the opsonic power of the patient's serum to be even greater than that of the normal individual. The measurements are always relative, the ratio between the average number of cells in the two sets of preparations constituting the *opsonic index*. This will be clear by studying the annexed diagrams.

Collecting vaccine from a calf.

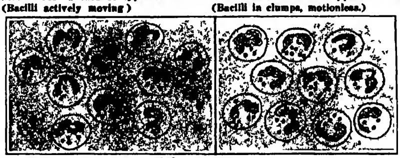
The calves which are used in the preparation of the virus are first washed, the long hair is clipped, and the skin is cleaned with an antiseptic solution, after which the surface to be operated upon is shaved. The animals are then conveyed to the operating room, where they are vaccinated with tested virus under conditions similar to those existing in the operating rooms of modern hospitals, after which they are transferred to the propagating stable and kept as clean as possible. In about six days the virus is removed as shown in the picture, and ground up into the pulp used to vaccinate human beings against small-pox.



Typhoid bacilli before the addition of serum from a case of typhoid fever. (Bacilli actively moving.)



Typhoid bacilli after the addition of serum from a case of typhoid fever. (Bacilli in clumps, motionless.)

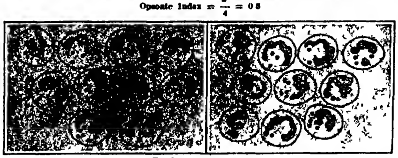


Before treatment.

THE PATIENT'S SERUM — Average number of bacteria per leucocyte = 2

SERUM FROM A NORMAL INDIVIDUAL — Average number of bacteria per leucocyte = 4

Opsonic Index $= \frac{2}{4} = 0.5$

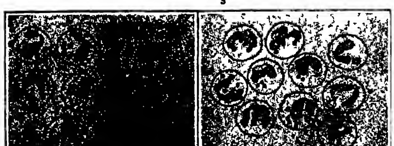


During treatment.

THE PATIENT'S SERUM — Average number of bacteria per leucocyte = 4

SERUM FROM A NORMAL INDIVIDUAL — Average number of bacteria per leucocyte = 3

Opsonic Index $= \frac{4}{3} = 1.33$



Treatment completed.

THE PATIENT'S SERUM — Average number of bacteria per leucocyte = 7

SERUM FROM A NORMAL INDIVIDUAL — Average number of bacteria per leucocyte = 2

Opsonic Index $= \frac{7}{2} = 3.5$

But this does not yet exhaust the list of antibodies produced by the animal body in response to injections of bacteria. When the serum of an animal which has been repeatedly injected with bacteria is brought into contact with some of these bacteria, careful observation under the microscope reveals an interesting series of changes. Thus, if typhoid bacilli are mixed with the serum of a rabbit which has previously been treated with injections of typhoid bacilli, or if the bacilli are mixed with serum from a patient suffering from typhoid fever, one notices first that the typhoid bacilli become sluggish in their movements. This is followed by the gradual collection of the bacilli into clumps. At the end of an hour or two, in place of countless bacilli moving quickly through the field, one sees merely several groups of absolutely immobile bacilli. This phenomenon is spoken of as agglutination, and the substance in the serum which brings it about as agglutinin. Like the bacteriolysins, the antitoxins, and the opsonins, the agglutinins are strictly specific, i. e., serum from an animal previously injected with typhoid bacilli will clump only typhoid bacilli, one from an animal injected with cholera bacilli will clump only cholera bacilli, etc. The simplicity of this reaction, as well as its specificity, has made it an important adjunct in the diagnosis of typhoid fever and other infections. The microscopic appearance of the bacilli before and after clumping is shown in the annexed drawings.

It must not be thought that the list of anti-substances above enumerated is at all complete, or, what is more, that invasion of the body by bacteria produces changes only in the blood. Not only are still other antibodies produced in the blood, but investigation has shown that other tissues of the animal body likewise undergo subtle changes in response to bacterial invasion. This fact is made use of in the diagnosis of tuberculous infection by means of the skin test. A small quantity of tuberculin (extract of tubercle bacilli) rubbed into a tiny abrasion in the skin of a tuberculous individual causes a typical inflammatory reaction at the point of application, while in uninfected individuals no such reaction results. The test is sometimes performed by dropping a weak solution of tuberculin into the eyes, causing a marked congestion (pink eye) in tuberculous individuals.

Because of the non-success attending the use of the antibacterial sera previously discussed, attention has been turned to treatment of bacterial infections by means of *active immunization*. This consists usually in injecting the patient with small doses of dead bacteria, thus causing the production, on his part, of the various antibodies already described, and so bringing about a condition of immunity. The injected dead bacteria are spoken of as a "bacterial vaccine." This method may be said to date from the researches of Pasteur concerning protective inoculation of animals against anthrax. It will be remembered that Salmon and Smith showed that even dead bacteria could be used for protective inoculation. The protective inoculations against typhoid fever as practised by the United States Army, consist of dead typhoid bacilli. Largely through the efforts of Wright such inoculations are also extensively used to cure an infection already in progress, and in a limited number of infections, strikingly successful results have been obtained. In a number of other infections, e. g., typhoid fever, the bacterial vaccines have been remarkably successful in preventing the disease, but practically without value in the treatment of cases already established. Even when used merely as a pre-

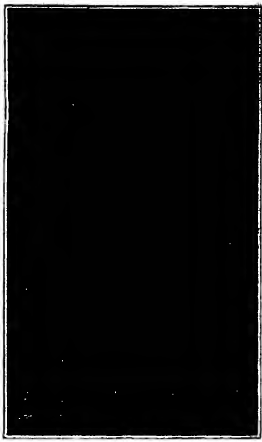
(Continued on page 549.)

Shape and Sound in Whistles

By Gustave Michaud, Costa Rica State College

If it be considered that whistles are among the oldest musical instruments the fact that very little is still known about the origin of the sound which they emit seems strange. One and the same explanation was found not long ago in nearly all elementary text books on acoustics. Condensations are produced we were told, at irregular intervals, by the collision of air against the cutting edge placed on its path. These oblige the current to escape at times through the opening placed above the edge. Dilatations follow the condensations and the tube reinforces such vibrations as its length permits. Like some streams of water the explanation is clear only because of its being shallow and the thoughtful reader tries in vain to find out the cause of the transformation of a continuous into an alternating motion. The discovery in organ pipes of the air whirlwinds called Looten's cyclones, which probably play a very important part in ordinary phonation, has still further complicated the problem and neither Hensen's theory of the pendulary motion of air nor the works of his opponents, Friedrich Krois and Wachsmuth, have so far thrown much light upon it.

It is none the less interesting to note the change undergone in recent years by the classical whistles G, O and M shown on the accompanying figure. Several minor improvements are mere applications of some well-known law of acoustics. Others are evidently the result of empirical research. Thus it is probable that whistles C, E and N owe their power to their shape, which highly favors the formation of Looten's cyclones, but how and why is not thoroughly understood. Whistle C is but a freaky imitation of E. It remains silent in the hands of the unaware person who does not use his fingers as lateral walls for the uncomplete cylindrical box. Whistles K and P embody an attempt to increase the volume of sound through an extension of the cutting edge around the whole instrument. Both are noisy calls but require powerful lungs. In the scientific instrument called Galton's whistle (H) length of pipe may be made to vary through the motion of the end screw. Pitch varies accordingly and the whistle is used to ascertain the individual upper limit of audible sounds, as it can produce those which cannot be heard, that is which result in over 40,000 vibrations per second. Pitch of whistles P and I can be made to vary, as in Galton's whistle, through changes in the length of pipe. In the American model, P, this is accomplished by merely pressing the rubber end of the whistle. The French whistle, I, is provided with a sliding end. In whistle B but two different sounds are produced, through a change from open to closed pipe, on top of the whistle is an opening which can be closed with the finger. Two sounds are also produced by whistles A and L, but they are simultaneous and, according to the maker's whim, give either a harmonious whole or a rough sound with perceptible beats. In L the two tubes are side by side, in A they are superposed. D has been considerably flattened in the plane containing the cutting edge, not, probably, to take advantage of Savart's law but merely to allow the easy carrying of the whistle in a vest pocket. So far as the origin of sound is concerned F cannot be called a whistle although it is used as such and gives a powerful whistling sound. It is probably the smallest siren ever made for practical purposes. It shows again that the characteristics of the whistling sound lie in pitch only and not in quality, moderate and steady blowing gives a sound that cannot be distinguished from that of other whistles. With this little siren as with Galton's whistle, the upper limit of perceptible sounds can be reached. J is a hybrid instrument whistle at one end trumpet call at the other. The same can be said of F, which carries a compass on one side.



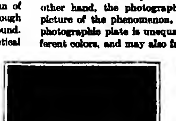
Classical, hybrid, scientific, practical and freak whistles.

Optical Phenomena Seen from Balloons

By C. Fitzhugh Talman

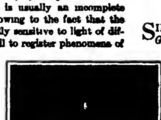
Besides the optical phenomena of the atmosphere which ordinary mortals may enjoy from time to time—rainbows, coronas, halos, the colors of sunrise and sunset, mirage, etc.—there are two interesting spectacles of this class which require, for their observation, an elevated point of view, and which are most favorably seen from balloons. These phenomena, especially when observed for the first time, usually make a profound impression upon the mind of the aeronaut, and have therefore frequently been described in narratives of balloon voyages.

The commoner of these is the Brocken specter. The reader is probably familiar with descriptions of this weird phenomenon as seen from the tops of mountains—not only the witch-haunted Brocken, but many other mountains the world over. The mountaineer sees his shadow cast upon a nearby bank of fog or cloud—apparently of colossal dimensions, though this is an illusion, due to an overestimate of the distance of the shadow from the observer. Surrounding the shadow there is often seen a circle of prismatic colors—technically called a *glory*—the center of which is that point in the shadow which corresponds with the position of the observer's eye. Hence, if the shadow is very near only the head appears circled with colored light, but if more distant the whole shadow is inclosed in the glory. This is one of several points in connection with the Brocken specter that are not made clear in the ordinary descriptions of it; while the usual pictures (drawings) are even worse, for they give the impression that the shadow cast by a person whom we will call *A*, with its attendant glory, may be seen by another person, *B*, from almost any distance or angle of view. The truth is, that *A's* specter and its rings can be seen only by himself, or by another standing very close to him. This is one illustration of the fact that drawings of nearly all the optical phenomena of the atmosphere are more often than not decidedly inaccurate and misleading, and points to the superiority, in certain respects, of the photograph—in which the artist's imagination and misconceptions can play no part. On the other hand, the photograph is usually an incomplete picture of the phenomenon, owing to the fact that the photographic plate is unequally sensitive to light of different colors, and may also fail to register phenomena of feeble luminosity, as the time of exposure is often insufficient, on account of the evanescent character of the subjects in question.



Photograph by Dr. A. Wegener.

Fig. 1.—Shadow of a balloon on the clouds, surrounded by rings of colored light.



Photographed from a balloon by Dr. A. Wegener.

Fig. 2.—Pseudhelion, the sun's image seen on a sheet of cloud below the observer.

We present herewith (*Fig* 1) the only photograph of the Brocken specter ever taken from a balloon. It was made by Dr Alfred Wegener, of the University of Marburg, Germany, on May 8th, 1910. Here the "specter" consists of the shadow, on the clouds, of the balloon and its basket; the latter surrounded by a brilliant glory. The glory showed the usual series of colors, ranging from blue inside to red outside, and this series was twice repeated. In order to identify the colors on the photographic plate, Dr. Wegener photographed with a similar plate the spectrum of an arc light, and observed the intensity of the image produced by its different parts. It was thus found that violet made no impression on the plate; that red and blue were very weak; that yellow was very strong, etc. From the relative intensity of the different parts of the glory, as seen in his photograph, he was able to reconstruct its colors with considerable accuracy, and to measure the angular width of the zone covered by each. The result was extremely interesting, as it showed some marked divergences from the theoretical dimensions of these rings as given in standard works on optics. The moral of this experiment is that scientific aeronauts should henceforth make every effort to secure good photographs of the Brocken specter, and in fact of all the optical phenomena of the atmosphere, in connection with which there are still many unsettled questions.

Fig. 2 is a photograph of the *pseudhelion* or *undersun*, and is also the first of its kind. It was taken by Dr Wegener on September 4th, 1910. There is very little literature concerning this phenomenon in English—and its name is unknown to the English dictionaries—although it was first described by the aeronauts Barral and Bixio, in connection with their balloon ascent of July 27th, 1850, and is mentioned in the English translation of Flammarion's book "The Atmosphere," published as long ago as 1873. (See p 144 of that work.) It is a bright image of the sun seen on a sheet of cloud lying below the observer—corresponding in position to the sun's image as reflected in a sheet of water. (It is quite distinct from the rare phenomenon of the *anthelion*, *antisun*, or *countersun*, seen at the same altitude as the sun, but on the opposite side of the sky. This, again, is quite different from the *anthelion* of the dictionaries, for which the name *glory* is now preferred by meteorologists, and which we have referred to above in connection with the Brocken specter. The terminology of atmospheric optics has been so embroiled by unscientific lexicographers that in writing on this subject one is obliged to define nearly every term one uses.)

As to the explanation of the two phenomena described above, the colored rings of the Brocken specter are produced by the diffraction of the sun's light around the tiny drops of water or crystals of ice forming a cloud or fog. The phenomenon is the same as the *corona* so often seen about the moon when shining through fleecy clouds, except that in the glory the light is not only dispersed by diffraction, but subsequently reflected to the eye of the observer. As the Brocken specter is always diametrically opposite the sun, it can rarely be seen from a mountain top except when the sun is low, while from a balloon it may be seen at any altitude of the sun. If the sun is in the zenith the balloonist will see the specter directly beneath him.

The pseudhelion is a member of the numerous halo family. It is an image of the sun reflected from the upper horizontal surface of ice crystals, of which, at low temperatures, clouds are composed. It has occasionally been seen surrounded by a circular or elliptical halo, either the common halo of 22 degrees radius, or an extraordinarily small halo having a radius of only from 1¼ to 2 degrees.

Nomenclature of the Polar Regions

Sir Clements Markham, writing in the *Geographical Journal*, takes exception to the custom of loading the maps of coast-lines in the polar regions with a multiplicity of "lands," belonging to a single geographical unit. Thus, the coast extending west from Ross Sea, in the Antarctic, has no less than thirteen "lands" strung along it, viz., Victoria, Adelie, Sabrina, Wilkes (this name is also applied to the whole coast), North, Totten, Budd, Knox, Termination, Kaiser Wilhelm, Kempe, Enderby, and Coates. Sir Clements does not mention a fourteenth, King George V, just added by the Mawson expedition, which has been exploring the coast in question. The writer also pays his respects to Amundsen (without naming him) in the emphatic statement that the great Antarctic Ice Cap was so named by Capt. Scott, its discoverer, and needs no other designation. It will be recalled that Amundsen named it the King Haakon VII Plateau. To the first of the above-mentioned complaints the reply might be made that, as there are no towns in the polar regions, and as the natural topographic features are in many cases more or less obscure, the so-called "lands" serve as convenient *points de repère*. It is, of course, understood that the term means no more, in this connection, than "region" or "district," and does not imply a natural subdivision of the earth's surface.

The Mathematical Works of the late Henri Poincaré will shortly be published in Paris under the auspices of the Ministry of Public Instruction and the Academy of Sciences.

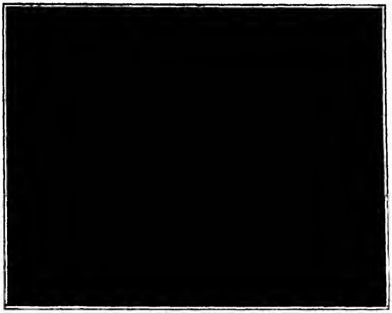
Down to Grade in the Culebra Cut

THE accompanying engraving pictures an event that marks an epoch in the history of the Panama Canal. On the afternoon of May 20th, 1913, steam shovel No. 222 from the north and shovel No. 230 from the south, each working on the floor of the canal, met opposite the town of Culebra, completing a channel at the bottom level of the canal the entire length of Culebra Cut. The canal will be completed when this channel has been widened to the required bottom width of 300 feet. To complicate matters several million cubic yards of material is being contributed by the various slides located near the Continental divide, where the cut is deepest. Col. Goethals plans to continue the excavation by steam shovels until October or November, 1913, when the cut will be flooded and the remaining excavation will be taken care of by dredges. Vessels of moderate draft may be permitted to use the canal soon after the flooding of Culebra Cut.

Meeting of the north and south excavation on the bottom level of Culebra.

Clearing a Bridge Wreck With the Oxy-acetylene Torch

INDIANAPOLIS has recently been engaged in removing with fire the wreckage caused by flood waters. Two bridges which crossed White River and Fall Creek, respectively, were badly damaged during the recent flood. Both bridges were of stone and concrete with a framework of heavy steel girders, and when they went down these supports were reduced to a mass of twisted junk, but withstood all efforts to remove them. Finally, the city engineer solved the problem of cutting away the steel wreckage by calling upon a company of that city that makes a well known automobile acetylene lighting system. In response to the appeal, two oxy-acetylene welding outfits were carried to the bridges and put into operation with cutting torch attachments. The steel girders were quickly severed. The entire work of cutting away the twisted mass of wreckage took only three days. With the cutting torch the girders were first heated and then a stream of pure oxygen was directed against the hot metal This caused the steel to burn quickly and safely The average time consumed in cutting a girder was a little over five minutes. The entire apparatus was mounted on a light two-wheeled truck This feature of portability has made the oxy-acetylene system of welding and cutting very desirable in cases where rapid work is necessary



Cutting bridge girders with the oxy-acetylene torch.

The Siamese King's Fire Engine

THE King of Siam recently ordered an up-to-date fire engine, but he did not care to have it self propelled or even provided with tongue or shafts for horse transportation, and so, although a gasoline engine is used to drive the fire pump, the machine has to be hauled to the fire by hand. Such a fire engine may strike us as ridiculous, but it is a sensible apparatus where the machine does not have to be hauled a great distance. In fact, fire engines of this type have been developed in England. One of them is employed by the Great Eastern Railway for protecting its property It is considered hardly worth while to provide the machine with motor propulsion, as no long trips would ever be demanded of it. The fire engine illustrated herewith, which is to be used for the protection of the Royal Palace at Bangkok, is fitted with a 45 to 50 horsepower, 4-cylinder engine, driving a 2-stage, 800-gallon turbine pump. The whole apparatus weighs about one ton.

A hand-drawn gasoline fire engine for Siam.

Night Golf Putting Course

By T. J. Little, Jr.

LAST year an article was published in the SCIENTIFIC AMERICAN SUPPLEMENT describing the lighting of the tennis courts of the Woodbury Country Club, Woodbury, N. J. This was probably the first [illegible] installation of its kind in the world, and it proved so popular that it occurred to the writer that it would be a good scheme to extend this field of artificial illumination to include the lighting of a golf putting course

The course is laid out on a plot of ground 40 by 80 feet and contains nine holes. It must be evident that night playing on such a course is highly desirable. In the first place, only a limited area has to be lighted, in the second place it makes it possible for business men and others who have not sufficient time during the day at their disposal to practise putting or to play a putting match at night A night tournament has already been played.

The installation of the lamps is comparatively simple Two wrought iron posts are used and two lamps are suspended from the ends of a long cross arm on the top of the posts. Four 5 mantle multi flex inverted gas arcs are used to light the course To reduce glare opaline globes were used on the lamps. A fairly uniform distribution of light over the course is desirable, the principal requisite, of course, being to have the nine holes uniformly lighted This was accomplished by spacing the holes so that they were not more than 10 feet horizontally distant from the lamps. The lamps are equipped with standard distributing reflectors, for it was found that the players not only desired to play on the course itself, but to approach the course with a mashie, and it is possible to do this at a distance of at least 100 feet The intensity at various holes is approximately 2½ foot-candles. The holes are painted white inside to make them easily visible from any part of the course To get a good idea of the ample illumination provided, it might be stated that it is considerably higher than that on the floor of an ordinary house at night as it is usually lighted

The remarkably uniform illumination is shown by the accompanying photograph, which was made by the light of the lamps alone on a dark night with an exposure of 1½ minutes.

The cost of lighting this golf putting course is 7¼ cents per hour for the gas consumed for the entire four lamps, each lamp consuming from 18 to 20 cubic feet of gas per hour, and the cost of gas in Woodbury being 90 cents per thousand cubic feet.

Golf putting course lighted by gas arcs.

Automobile Traction in Italy

THE Italian government recently gave a striking proof of the favor which automobile traction is meeting with in that country, by deciding to allow subsidies for the establishment of new power wagon or autobus lines in addition to what are now being operated in that country so that in the near future there will be twenty four new automobile lines operated. Their object is to give a direct connection between isolated villages and the industrial centers or at least to connect them with the nearest railroad station, and thus awaken progress by the traffic facilities afforded. Several lines which are to be used for places where commerce is becoming developed are laid out for freight transport by medium sized power wagons, and this is an interesting example for generally such lines were designed for passenger and baggage service only The new power wagon lines will foot up a total distance of 500 miles, and will cover rough country in many cases. Such a ramification of the railroad lines, as it may be termed will give the greatest service in opening up the country to trade in general. As a result of the rapid progress made in power wagon matters in Italy the government is taking up the question of good roads and will go into extensive improvements which will require about $1,000,000 for the present stage of the work. As in the case of other European countries, the power wagon lines will penetrate into parts of the country where railroads could not be run owing to the nature of the ground, and thus such localities will no longer be in a disadvantageous position

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Silencer for Gas Engines

FOLLOWING his well known invention of the silencer for rifles, Mr Hiram Percy Maxim turned his attention to the noisy exhaust of the gas engine and has evolved a silencer which will muffle or deaden that noise and smooth out the sharp gaseous impulses. The silencer consists of a nested series of spiral shells between which are formed spiral whirl chambers, that the exhaust must traverse In order to increase the silencing effect these spiral whirl chambers are alternately reversed in direction, so that the gases in passing through them must travel alternately in a right handed and in a left handed direction The whirl chambers are progressively larger, permitting the gases to expand. The arrangement of the spiral shells is shown in the accompanying drawing They are inclosed in a cylindrical casing At the inlet end of the silencer, there is an end plate A formed with flanges A^1 Near the outlet end of the silencer is a support B, also formed with annular flanges B^1 The shells C are mounted between the plate A and support B, and are fitted between the flanges. The parts are held in place by means of long bolts D, which pass from the plate A through the support B and the end plate E The bodies of these bolts are flattened where they pass between the spiral shells, so as to offer as little resistance as possible to the flow of gases. They may be seen in section in the enlarged view of the silencer It will be observed that the spiral shells are formed with lapping ends to provide discharge throats to the succeeding whirl chambers. The shells are so arranged that each discharge throat is angularly advanced in its discharging direction beyond that of the succeeding whirl chamber In some types of these silencers, certain of the spiral shells, particularly the outer ones, are corrugated, so as to retard the flow of the gases. The arrows indicate the course of the gases through the silencer They enter at F, and pass successively through the whirl chambers, finally issuing into the chamber formed between the outer spiral shell and the wall of the casing Thence they pass over the end of the support B, and out through the exhaust port G In the end plate A, a passage H is formed, through which cooling water may be admitted to the first whirl chamber of the silencer In the opposite end plate E there is a port J adapted to be fitted with a drip connection for the discharge of the cooling fluid from the silencer

Nested spiral whirl chambers to silence gas engine exhaust.

A home cinematograph, which generates its own current.

Moving Pictures at Home

THE public entertainment possesses this disadvantage that it must suit a heterogeneous assembly of people of varied interests and tastes. Consequently, its programme must be made up of a variety of subjects which may not altogether satisfy any one of the audience or spectators. If the entertainment is a concert a disappointed listener can at least go home and make up the deficiency with his own piano, player piano or phonograph or on the other hand if one has heard something that particularly strikes his fancy he may purchase the selection and reproduce it to his heart's content at home In the case of the moving picture show however, the spectator is obliged to accept a 'table d hote' programme even though prepared for a public whose tastes are absolutely at variance with his own, on the chance of witnessing now and then a selection that he finds interesting and instructive. But he cannot reproduce these selections or make up his own programme at home, at least he has not been able to do so heretofore, for the reason that up to the present time there have been no practical cinematographs for home use. Although a machine of this character was placed on the market a year or two ago, it was found deficient in a number of respects and was finally withdrawn by the manufacturer Now, however, a hand operated home cinematograph has just been put on the market which is very promising. It is manufactured by a well known foreign cinematograph company and has already met with great success abroad. The machine is shown in the accompanying photograph.

One of the first questions that occurs to a man who is contemplating the introduction of a cinematograph into his home is the danger of fire. The new machine employs fireproof films made of acetyl cellulose and to make sure that the owner may not attempt to use the highly inflammable films of the commercial machine, it is designed to take a special form of film which can be had from the manufacturers only

The source of light is another important question. In the machine which was withdrawn from the market because it proved to be impracticable, a carbon arc lamp was employed This called for much heavier current than could be obtained without a special circuit. In the new cinematograph no connection with the lighting circuit is necessary for the machine generates its own current in sufficient quantity to light a small osram lamp

The generator, which is in the form of a magneto, may be seen in the foreground of the accompanying photograph. It is operated through suitable gearing by a crank handle and is fitted with a governor to prevent excessive velocity of the armature. The osram lamp is placed in small light-tight casing fitted with a reflector and condenser So little heat is generated that there is no possible danger of injuring the film, particularly when we realise that the flow of current and feed of the film are effected by one and the same crank handle so that the film cannot be stalled without arresting the flow of current as well.

The film is given an intermittent motion in front of the lamp by mechanism similar to that employed in the commercial machine. Very little effort is required to operate the machine. It projects a picture measuring about three by four feet at a distance of ten or twelve feet, the exact dimensions depending, within limits, upon the distance of the screen from the camera Hence the machine may conveniently be used in the ordinary parlor or sitting room. A large library of films has already been prepared for this machine, including in addition to those of the customary dramatic and vaudeville type of exhibition, a wide variety of educational subjects, which should make an instrument of this sort particularly valuable in the class room.

An Intensifier for Telephone Transmission

By Jacques Boyer

HAS it ever occurred to the reader that there is something very artificial about our present method of speaking over the telephone? The mouthpiece is so constructed that it gathers only those sounds which proceed directly from the mouth, whereas in actual speech, a not inconsiderable portion of the sounds emitted are carried more or less completely through the nose. All such sounds must be almost completely lost in an ordinary telephone conversation, and we can therefore not be surprised at the voice sacrifice

Diagram showing the action of the soft palate in directing a part of the breath in speech through the nasal passages (figure on left) or closing off these passages and directing the entire stream out through the mouth (as shown on right) Two mirrors placed, one under the nose, the other before the mouth, catch the breath and thereby indicate the relative strength of the two streams.

Dr. Glover using his transmitter with nose-piece attachment.

over the wires, although recognizable to one accustomed to the instrument, nevertheless differs materially from that of ordinary speech.

Hitherto telephone engineers, in attacking the problem of increasing the distinctness of transmission of the voice over the telephone, have mainly concentrated their attention upon improvements in the construction of the microphone, or else upon improvements in the design of the telephone line. No one, until recently, seems to have paid much attention to the study of the human voice and its peculiarities with a view to applying the observations thus obtained for perfecting telephony. It is by starting from such a basis as this that Dr. Jules Glover has evolved an apparatus shown in our illustration, by the aid of which the sound carried over the wire is much intensified and the clearness of speech is greatly increased, a matter which is of no small importance, especially for long distance transmission.

Inasmuch as in the telephone the electric current reacts upon the magnet in the receiver, not so much by its intensity, but by the variations in its intensity, it is necessary, if the ear is to receive as perfect as possible a rendering of the sound impressed upon the transmitter, to reproduce as exactly as possible all the modulations of the voice. To realize just what this implies, we must bear in mind the construction of our throat. On issuing from the pharynx the sound waves impinge upon the soft palate, which divides them into two unequal parts, of which the one escapes through the nose, while the other issues at the mouth (see our illustration). Evidently to obtain a perfect result, it is necessary that each of these two groups of sound waves be transmitted in proper proportion over the telephone, while as a matter of fact, the instruments in common use transmit almost exclusively the mouth waves, so that nearly one half of the voice remains unutilized. This is not a mere guess, but can be actually proved experimentally by recording by photographic means the variations in the intensity of the microphone current, which can be done by the aid of an oscillograph, a simpler means to effect the same end, perhaps less perfectly, is to observe the condensations of the breath from the mouth and nose by means of mirrors or other suitable devices. It is found that the records so obtained for the mouth and nose differ for the same word, according to loudness of speech.

In the improved telephone invented by Dr. Glover, contrary to the usual custom, the entire voice assists in producing the electro-magnetic phenomena by the aid of which speech is transmitted. The new apparatus differs from the customary form in that it possesses two microphone transmitters one for the mouth and one for the nose, each of properly adjusted sensibility. The couple of mouthpieces is attached to a handle as in the ordinary telephone.

Microphones of this kind can be used directly in the primary without conversion battery and without induction coil. The apparatus functions perfectly by the use of a single central battery, giving 24 volts or less. The uniform resistance has a total of 150 ohms, which, however, can be adjusted to suit circumstances. The induction coil can be omitted as the variations in the intensity of the current due to the voice are found to be sufficiently accentuated without it. Nevertheless, transmission is somewhat assisted by the use of the coil.

As a matter of hygiene, a roll of tissue paper may be passed in front of the mouth and nose to prevent any possible infection, the tissue paper being renewed automatically at each call.

A School Girl Inventor.—A school girl attending the Business High School in Washington City realizing the need of a pocket, notwithstanding fashions decree to the contrary, recently appeared at school in a collar of her own invention in which she had formed pockets at either side. One pocket was adapted for carrying small change and the other for carrying a lead pencil or similar small articles.

The Supreme Court of the United States on Price Maintenance

*The right of the patentee to fix the retail price of articles embodying his invention and to treat as an infringement of his patent any attempt to sell at other prices has now been squarely passed upon by the Supreme Court of the United States in Bauer & Co and the Bauer Chemical Company v James O'Donnell. In legal history this will be known as the Sanatogen Case. The decision of the Supreme Court is of immense importance to the public, to retailers and to manufacturers. It denies absolutely the right of a patentee to control the selling price of his product after it leaves his hands. The following is an abstract of the decision.—*Editor.

The right to make, use and sell an invented article is not derived from the patent law. This right existed before and without the passage of the law and was always the right of an inventor. The act secured to the inventor the *exclusive* right to make, use and vend the thing patented, and consequently to prevent others from exercising like privileges without the consent of the patentee. Bloomer v. McQuewan, 14 How., 539, 540, Continental Paper Bag Company v. Eastern Paper Bag Company, 210 U. S., 405, 425. It was passed for the purpose of encouraging useful invention and promoting new and useful improvements by the protection and stimulation thereby given to inventive genius, and was intended to secure to the public, after the lapse of the exclusive privileges granted, the benefit of such inventions and improvements. With these beneficent purposes in view the act of Congress should be fairly or even liberally construed, yet, while this principle is generally recognized, care should be taken not to extend by judicial construction the rights and privileges which it was the purpose of Congress to bestow.

In framing the act and defining the extent of the rights and privileges secured to a patentee Congress did not use technical or occult phrases, but in simple terms gave an inventor the exclusive right to make, use and vend his invention of a definite term of years. The right to make can scarcely be made plainer by definition, and embraces the construction of the thing invented. The right to use is a comprehensive term and embraces within its meaning the right to put into service any given invention. And Congress did not stop with the express grant of the rights to make and to use. Recognizing that many inventions would be valuable to the inventor because of sales of the patented machine or device to others, it granted also the exclusive right to vend the invention covered by the letters patent. To vend is also a term readily understood and of no doubtful import. Its use in the statute secured to the inventor the exclusive right to transfer the title for a consideration to others. In the exclusive rights to make, use and vend, fairly construed, with a view to making the purpose of Congress effectual, reside the extent of the patent monopoly under the statutes of the United States. Bloomer v. McQuewan, 14 How., 549.

The case presented pertains to goods purchased by jobbers within the District of Columbia and sold to the appellee at prices not stated, and resold by him at retail at less than the price of one dollar fixed in the notice. The question therefore now before this court for judicial determination is. May a patentee by notice limit the price at which future retail sales of the patented article may be made, such article being in the hands of a retailer by purchase from a jobber who has paid to the agent of the patentee the full price asked for the article sold?

The object of the notice is said to be to effectually maintain prices and to prevent ruinous competition by the cutting of prices in sales of the patented article. That such purpose could not be accomplished by agreements concerning articles not protected by the patent monopoly was settled by this court in the case of Dr. Miles Medical Company v. Park & Sons Company, 220 U. S., 373, in which it was held that an attempt to thus fix the price of an article of general use would be against public policy and void. It was doubtless within the power of Congress to confer such right of restriction upon a patentee. Has it done so? The question has not been determined in any previous case in this court, so far as we are aware. It was dealt with under the copyright statute, however, in the case of Bobbs-Merrill Company v. Straus, 210 U. S., 339. In that case it was undertaken to limit the price of copyrighted books for sale at retail by a notice on each book fixing the price at one dollar and stating that no dealer was licensed to sell it for less and that a sale at a less price would be treated as an infringement of the copyright. It was there held that the statute, in securing to the holder of the copyright the sole right to vend copies of the book, conferred a privilege which, when the book was sold, was exercised by the holder, and that the right secured by the statute was thereby exhausted. The court also held that it was not the purpose of the law to grant the further right to qualify the title of future purchasers by means of the printed notice affixed to the book, and that to give such right would extend the statute beyond its fair meaning and secure privileges not intended to be covered by the act of Congress.

Section 4952 Revised Statutes, a part of the copyright act, secures to an author, inventor, designer or proprietor of books, maps, charts or dramatic or musical compositions the sole liberty of printing, reprinting, publishing, completing, copying, executing, finishing and vending them. While that statute differs from the patent statute in terms and in the subject matter intended to be protected, it is apparent that in the respect involved in the present inquiry there is a strong similarity between and identity of purpose in the two statutes. In the case of patents the exclusive right to vend the invention or discovery is added to the like right *to* make and use the subject matter of the grant, and in the case of copyrights the sole right of multiplying and reproducing books and other compositions is coupled with the similar right of "vending the same." So far as the use of the terms "vend" and "vending" is concerned, the protection intended to be secured is substantially identical. The sale of a patented article is not essentially different from the sale of a book. In each case to vend is to part with the thing for a consideration.

It is apparent that the principal difference in the enactments lies in the presence of the word "use" in the patent statute and its absence in the copyright law. An inventor has not only the exclusive right to make and vend his invention or discovery, but he has the like right to use it, and when a case comes fairly within the grant of the right to use, that use should be protected by all means properly within the scope of the statute.

Chief reliance, however, of the plaintiff in this case is upon the recent decision of this court in Henry v. Dick Company, 224 U. S., 1. An examination of the opinion in that case shows that the restriction was sustained because of the right to use the machine granted in the patent statute, distinguishing in that respect the patent from the copyright act. In that case a patented mimeograph had been sold which bore an inscription in the form of a notice that the machine was sold with the license restriction that it might only be used with stencil, ink and other supplies made by the A. B. Dick Company, the owners of the patent. The alleged infringer sold to the purchaser of the mimeograph a can of ink suitable for use with the machine with full knowledge of the restriction and with the expectation that the ink sold would be used in connection with the machine. It is expressly stated in the opinion that the machine was sold at cost or less and that the patentee depended upon the profit realized from the sale of the non-patented articles to be used with the machine for the profit which he expected to realize from his invention (224 U. S., 26). After commenting upon the copyright statutes and the resemblance between the author's right to vend copies of his work and the patentee to vend copies of his work and the patentee's right to vend the patented thing, it was said (page 46)

"To the inventor by Section 4884 Revised Statutes, there is granted the exclusive right to make, use and vend the invention or discovery. This grant as defined in Bloomer v. McQuewan, 14 How. 539 549 consists altogether in the right to exclude every one from making, *using* or vending the thing patented. Thus, there are several substantive rights and each is the subject of subdivision so that one person may be permitted to make but neither to sell nor use the patented thing. To another *may* be conveyed the right to sell but within a limited area, or for a particular use while to another the patentee may grant only the right to make and use, or to use only for specific purposes. Adams v. Burke 17 Wall 453. Mitchell v. Hawley 16 Wall 544. Rubber Company v. Goodyear 9 Wall., 788 790." (*Italics* in the original opinion.)

That case was distinguished from Bobbs-Merrill versus Straus, construing the copyright act, because of the difference in the terms of the copyright and patent statutes, the patent act conferring not only the right to make and sell but the exclusive right to *use* the subject matter of the patent. It was under the right to use that the license notice in question was sustained and it is obvious that the notice in that case dealt with the use of the machine and limited it to use only with the paper, ink and supplies of the manufacture of the patentee. While the title was transferred it was a qualified title, giving a right to use the machine only with certain specified supplies. It was said in the Dick case that "there is no collision whatever between the decision in the Bobbs-Merrill case and the present opinion. Each rests upon a construction of the applicable statute, and the special facts of the cases."

It is contended in argument that the notice in this case deals with the use of the invention, because the notice states that the package is licensed "for sale and use at a price not less than one dollar," that a purchase is an acceptance of the conditions, and that all rights revert to the patentee in event of violation of the restriction. But in view of the facts certified in this case, as to what took place concerning the article in question, it is a perversion of terms to call the transaction in any sense a license to use the invention. The jobber from whom the appellee purchased had previously bought, at a price which must be deemed to have been satisfactory, the packages of Sanatogen afterward sold to the appellee. The patentee had no interest in the proceeds of the subsequent sales, no right to any royalty thereon or to participation in the profits thereof. The packages were sold with as full and complete title as any article could have when sold in the open market, excepting only the attempt to limit the sale or use when sold for not less than one dollar. In other words, the title transferred was full and complete with an attempt to reserve the right to fix the price at which subsequent sales could be made. There is no showing of a qualified sale for less than value for limited use with other articles only, as was shown in the Dick case. There was no transfer of a limited right to use this invention, and to call the sale a license to use is a mere play upon words.

The real question is whether in the exclusive right secured by statute to "vend" a patented article there is included the right, by notice, to dictate the price at which subsequent sales of the article may be made. The patentee relies solely upon the notice quoted to control future prices in the resale by a purchaser of an article said to be of great utility and highly desirable for general use. The appellee and the jobbers from whom he purchased were neither the agents nor the licensees of the

(*Concluded on page 547.*)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

NECKTIE CASE.—T P FORMAN Circuit Ave Waterbury Conn. The invention pertains to improvements in necktie cases, and the object is to provide an improved structure which is adapted to be folded so that the respective ties will face each other and all the ties be covered when the case is closed

HEATER FOR HAT BRIMS—M HERSHKOWITZ and J FRIEDMAN 715 Jackson Ave Bronx N Y The invention provides a heater for brims adapted to concentrate the heat thereon and to avoid undue heating of the crown and provides means for suspending the hat above a radiating plate to avoid burning the hat during the process of heating the brim.

Electrical Devices.

ELECTRIC SOLDERING IRON—F M. GIFFEN 219 Sequin St San Antonio, Tex This inventor provides a soldering iron having a receptacle for the solder from which the melted solder may be delivered as desired He also provides novel means for permitting the flow of solder and for shutting it off

MAGNETIC SWITCH—C G MILLER, 156 W 65th St. Manhattan N Y N Y The invention has particular reference to a magnetically operated device which is adapted for the operation of any element through magnetic influence said element to be operated in the opposite direction when the magnetism ceases either by gravity or some other means.

Of Interest to Farmers.

TETHER—H L DUXSTAD, Cambridge Wis. This invention provides a device by means of which an animal may be tethered to a stake but which will prevent injury to the animal such as that often occasioned by entanglement with the rope By means of the device a rope which forms one of the tethering members may be kept always taut and out of the way of the animal

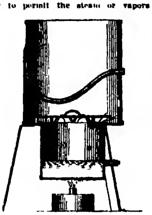
MIXING TANK—C E MINGES Hamburg, Iowa The invention is for the mixing of Bordeaux solution for use in spraying orchards, vineyards and field crops. It provides for effecting the mixture in the tank of the wheeled sprayer whereby it is necessary only to have barrels of stock solution at points in the orchard where water is available thereby doing away with expensive and cumbersome fixed series of tanks.

SAP COLLECTING APPARATUS—G H. SOULE, Fairfield Vt Among the principal objects in view in this invention are to provide an apparatus having means for suspending and covering the sap-collecting bucket, and to provide means for preventing the withdrawal of the support for said apparatus

COMBINED PNEUMATIC LIFT AND FORCE PUMP F O DE HYMEL, 110 Soledad St San Antonio Tex. This apparatus is particularly adapted for irrigating tracts of 10, 20 50 or even 100 acres, and for lifting water from various depths. It may be easily and quickly shifted from one well or a series of wells to another and thus an effective irrigation maintained throughout the dry months with little labor and expense It is particularly adapted for use in the semi arid regions of the West, Mexico, and other places, and also with draft horses.

Of General Interest

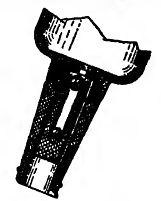
HEAD STEAMING APPARATUS—A F KNIESCHE 2538 Frederick Ave Baltimore Md In use the steam rising from the lower vessel is deflected toward the sides of the steaming chamber to permit the steam or vapors to



HEAD STEAMING APPARATUS.

come in contact with the head of a person preferably covered during the steaming operation with a piece of cloth rubber or the like extending over the upper open end of the steaming vessel above By means of a deflector the water boiling in the lower vessel is not liable to come into contact with the face and hence burning thereof is prevented.

NON-REFILLABLE BOTTLE.—J G. TAYLOR and C. T EATON, 185 Franklin St., Boston, Mass. The invention refers to storage vessels provided with means for preventing refilling the same, and it comprises features whereby the inflow of liquid after the vessel



NON REFILLABLE BOTTLE.

has been emptied is effectually prevented. These features include a member acting as a valve to check the inflow of liquid, this member being buoyant so that it will be carried against the edge of the opening through which the liquid must pass to enter the interior of the vessel and effectually close this opening.

NECK FOR BANJOS OR THE LIKE.—O SCHMIDT 87 Ferry St Jersey City N J This invention relates to banjos and similar musical instruments, and its object is to provide an improved fastening device more especially designed for securely and quickly fastening the rim to the neck of the instrument

PICK HOLDER.—S YOUNG, Cedar Point, Ill. This invention relates to means for handling miners picks, and has particular reference to a device whereby a number of picks may be clamped together in a bundle and handled in large numbers without danger of breakage of the handles or otherwise damaging the picks.

DETACHABLE ANCHOR BOLT—C BUTLER, 1170 Broadway N Y N Y This improvement refers to fastening devices adapted especially for concrete building constructions. An object is to devise an anchoring means which will be more reliable in use by reason of its positive connection with the concrete construction than devices heretofore proposed for this purpose

FIRE EXTINGUISHER.—S. L. HARWOOD, Dublin, Ga This improvement comprises features of construction by means of which the likelihood of the extinguisher being injured or made to operate when not needed, by rough handling, is practically eliminated, while at the same time the device remains capable of being put to an instant use when occasion arises.

TYPE GUARD—W G MACMILLAN 268 W 141st St New York, N Y The ends of the type guard are held yieldingly extended, so that the type guard may be disposed between reglets for holding the type set between the reglets in position, and without it being necessary to fill the space between the reglets and between the type with furniture and quoins. One or more of these guards may be arranged for holding type and cuts in position when the type is set and cuts are arranged for display

FILTER.—E. SEAVEY 116 W 102nd St., New York, N Y This invention relates to filters such as in the Letters Patent of the U S No. 1,035,348, granted to Mr Seavey The present invention is arranged to insure thorough straining of the sediment or other foreign matter contained in the liquid to be filtered, and to permit of readily cleaning the filter when desired.

COIN AND MAIL HOLDING DEVICE FOR MAIL BOXES.—J E. SHINN R. F D No. 2, Box 26 Conway Springs, Kan. This is an improvement in devices for holding coins, post cards and letters in mail boxes, and the device may be placed on the interior of any mail box and will permit a postman to pick up letters or postals or to take out the coin without the necessity of removing his gloves to do so.

Hardware and Tools.

HOSE COUPLING—V S. PERASIO, 1053 Monroe Ave, Detroit, Mich. The more particular purpose of this invention is the provision of a type of hose coupling suitable for use by fire departments, and of such construction that the two adjacent ends of consecutive hose sections may be quickly and securely gripped together

SUGAR SAMPLER.—J N. EMBS, 92 Morningside Ave., New York, N Y The design of the invention is to provide a sampler of such form that the device may be entered into sugar bags when the latter are piled up, under which conditions it is exceedingly difficult to cause triers of ordinary form to penetrate the bags of sugar the pressure resulting from the piling of the bags offering a great resistance to the entrance of the trier

SAFETY RAZOR.—C. G. BLAKE, 268 Willoughby Ave., Brooklyn, N. Y. This invention provides a blade and holder co-acting therewith for positively holding the blade in proper position against accidental movement. It provides a guard plate designed to accommodate a blade formed with a slot, and also a clamping member passing through the eyelet and pressing against the blade for holding the same firmly against the guard plate.

PEAVEY OR CANT HOOK.—A. LAMMERS, care of J F T R. BRUNNER, St. Paul, Ore. The invention has particular reference to a peavey or cant hook used by lumbermen which comprises a cylindrical handle provided at one end with a slightly tapering metal ferrule supporting the hook proper at one side and intermediate its ends, and having a spur at its extremity

LOCK.—H. S. HASKIN, Lents, Ore. In this case the invention is an improvement in locks, and the object is to provide a device simple in construction and operated by push buttons to open and to close the same, and having means for locking the bolt in extended position.

Household Utilities.

INVALID BED.—W C. FEELY, 379 First Ave., Manhattan, N Y., N Y The invention provides a bed which may be dismembled or knocked down for storage or handling, provides means for elevating the body of a patient, or parts thereof, to vary the position of the patient, provides means for suspending the patient above the bed proper, to facilitate changing of bed furnishings, and provides commode-supporting means for operating the same

WINDOW CLEANER.—HENRIETTA K. PARKE, R. 110 Vendome Hotel, Chicago, Ill This invention provides a cleaner with a base and inner and outer standards hinged thereto, so that the base may be disposed on a window sill, and the standards may be erected to vertical positions one at outside the other at inner side of the window cleaner members being provided which are mounted on guides for traveling on standards, the guides being supported by means for moving the two guides simultaneously in the same direction.

Machines and Mechanical Devices.

GRADING SCRAPER.—J F THOMAS and J HARVEY, care of J L. GANS, Odessa Minn. The object of the inventors is to provide a wheeled frame and a shovel scraper adjustably mounted in the frame in such manner that it may

GRADING SCRAPER.

be caused to scrape and remove the surface of the soil beneath the frame when the latter is moved and may be further adjusted to a position wherein its contents may be either dumped as a whole or gradually leveled out after transportation to a desired point.

CLEANER FOR FIREARM BARRELS.—M W P'POOL, Winters, Tex Mr P'Pool in his invention has for an object the provision of a cleaner for firearm barrels, which may be conveniently carried in the pocket, and which may be used for cleaning firearms of the repeating type having ejector slots too short to admit of the use of cleaners now on the market.

INDICATING MECHANISM FOR TIME PIECES.—O E GIBBY, care of Messrs. A Wittnauer & Co., 30 W 36th St., New York N Y The invention provides indicating mechanism for watches, clocks, etc., and arranged to indicate the wound up state or condition of the main spring, that is, to enable the user to see at a glance whether the timepiece is wound or not, at the same time enabling the user to correctly and fully wind up the piece without danger of over winding and breaking the main springs.

WASHING MACHINE FOR MILK SEPARATOR DISKS—H G BEMIS, Riceville, Iowa The invention provides a machine adapted to be handled as a portable member, provides a machine with a loading member adapted for handling as a carrier for the disks prior to loading, provides a brush for operation upon the edge portion of the disks, and provides means whereby the loading member is held centrally in the machine.

SEPARATING MACHINE.—M W TRUYAICA, Rua Tamandare 194, Sao Paulo, Brazil. The invention comprehends an apparatus whereby the material such as coffee, cereals, etc., to be assorted or graded may be fed continuously into the machine, and through the aid of a number of separating sieves a grading may be effected, the graded material being discharged through separate chutes into separate bins.

ECCENTRIC BALANCE COMPUTING SCALE.—R. PIERSON, Rollwitz, Neb. This invention is an improvement in eccentric balance computing scales, and has for its object the provision of simple, easily operated means for weighing an article, and for indicating not only the weight of the said article, but also the price of the same in money

Railways and Their Accessories.

TRIP STANCHION FOR LOGGING CARS.—V L. MORRIS, R. F D. No. 2, Box 24, Ellis, Miss. An object here is to provide a trip which may be operated from the opposite side of the car from that from which the logs are to be unloaded. A further object is to provide means for locking the trip in its extended position and for unlocking it without the necessity of the application of a tool.

FREIGHT CAR LADDER.—W. A. MITCHELL, care of M. K. & T. R. R., Mobile, Ala. The invention provides ladders for the sides and ends of freight cars, which are in conformity with the United States safety appliance law, and which possess features that render these ladders safer than the ordinary ones.

SWITCH OPERATING MECHANISM.—E. J KNOWLTON, 222 Old Sixth St., Birmingham, Ala. In the present patent the invention is an improvement in switch operating mechanism and particularly in that class of such mechanism wherein the devices for moving the switch are operated from a moving locomotive or car

Pertaining to Recreation.

GAME.—J GREENE, 216 E. Broadway, Salt Lake City, Utah. This invention relates to game apparatus and has particular reference to this character of apparatus in making use of a board having a plurality of grooves or channels and a plurality of moving members or disks arranged in a number of sets of different colors.

Pertaining to Vehicles.

COKE AND COAL WAGON.—M. L. SANDERLING, 333 Fairmount Ave., Jersey City, N J This wagon is of the hopper bottom type of vehicles and has one or more compartments, the compartments adapted to be separately discharged, and the load of each compartment being delivered out of the outside of the wheel base and substantially in bulk.

GARDENER'S WHEEL CHAIR.—IRA M PARSONS, Pleasant Valley, N Y By means of this convenient chair, berries or vegetables growing at different heights from the ground may be easily picked without the person getting off the chair, which can be easily guided and propelled while sitting on same, and in which the wheel base is such as to run on the paths running along the sides of rows or beds of vegetables or berries.

Designs.

DESIGN FOR A STREET LIGHT STANDARD.—J MCL. PETTYJOHN care of the Pettyjohn Co., Terre Haute, Ind. The grooved

STREET LIGHT STANDARD.

column in this design stands upon a plain base and supports four arms, pendent from each of which is a round globe Capping the arms and in their center is an upright globe materially larger than the others.

DESIGN FOR CARPET OR RUG.—W R. SAYERS, care of G. S. Squire, 25 Madison Ave., New York, N Y Mr Sayers has designed three carpet or rug designs Nos. 43,945, 43,946, and 43,947 Each one has a border comprising several neat and beautifully patterned bands The first and third have center designs of very small conventional figures, while the second has a field of vines, flowers, and leaves amid a geometrical composition.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY You will find inquiries for certain classes of articles numbered in consecutive order If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. In every case it is necessary to give the number of the inquiry. Where manufacturers do not respond promptly the inquiry may be repeated

Munn & Co., Inc.

Inquiry No. 9303 Wanted the name of manufacturer who could make newly patented articles made from 18 to 22 gage sheet aluminum.

Inquiry No. 9304. Wanted the names and addresses of manufacturers of a second hand rug cleaning machine on the order of a carpet cleaning machine.

Inquiry No. 9305. Wanted the name and address of concerns making paper letters and figures.

Inquiry No. 9306. Wanted small hardware and other specialties to be sold in notion and grocery stores. Wanted to buy wholesale.

Inquiry No. 9307 Wanted to buy a machine for [illegible] and [illegible] safety razor blades on a [illegible] scale.

Inquiry No. 9308. Wanted woven glass fabric for [illegible] purposes in large quantities. The [illegible]

Inquiry No. 9309 Wanted to buy small woven [illegible] for use over the temple [illegible] where they go around the ears.

Inquiry No. 9310. Wanted addresses of manufacturers of [illegible] articles for mail order business [illegible] of spools.

Inquiry No. 9311. Wanted names and addresses of [illegible] made of colored [illegible]

Inquiry No. 9312. Wanted to buy a machine [illegible]

[illegible]

The Supreme Court of the United States on Price Maintenance

(Concluded from page 545.)

patentee. They had the title to, and the right to sell, the article purchased without accounting for the proceeds to the patentee and without making any further payment than had already been made in the purchase from the agent of the patentee. Upon such facts as are now presented we think the right to *vend* secured in the patent statute is not distinguishable from the right of *vending* given in the copyright act. In both instances it was the intention of Congress to secure an exclusive right to sell, and there is no grant of a privilege to keep up prices and prevent competition by notices restricting the price at which the article may be resold The right to vend conferred by the patent law has been exercised, and the added restriction is beyond the protection and purpose of the act. This being so, the case is brought within that line of cases in which this court from the beginning has held that a patentee who has parted with a patented machine by passing title to a purchaser has placed the article beyond the limits of the monopoly secured by the patent act

In Adams v Burke, 17 Wall., 453, Mr Justice Miller, delivering the opinion of the court, pertinently said (page 455)

"The vast pecuniary results involved in such cases as well as the public interest admonish us to proceed with care, and to decide in each case no more than what is directly in issue.

"The true ground on which these decisions rest is that the sale by a person who has the full right to make, sell, and use such a machine carries with it the right to the use of that machine to the full extent to which it can be used in point of time.

"The right to manufacture, the right to sell, and the right to use are each substantive rights, and may be granted or conferred separately by the patentee.

"But in the essential nature of things, when the patentee or the person having his rights, sells a machine or instrument whose sole value is in its use he receives the consideration for its use and he parts with the right to restrict that use. The article in the language of the court, passes without the limit of the monopoly That is to say the patentee or his assignee having in the act of sale received all the royalty or consideration which he claims for the use of his invention in that particular machine or instrument, it is open to the use of the purchaser without further restriction on account of the monopoly of the patentees

Bloomer v McQuewan, *supra*, Goodyear v Beverly Rubber Company, 1 Cliff , 348, 354, 10 Fed. Cases, 638, Chaffee v Boston Belting Company, 22 How., 217, 223, Keeler v Standard Folding Bed Company, 157 U S., 659

Holding these views, the question propounded by the Court of Appeals will be answered in the negative, and

It is so ordered.

Dissenting Mr Justice McKenna, Mr Justice Holmes, Mr Justice Lurton and Mr Justice Van Devanter.

Five Ordnance Patents.—William D Smith of Washington, D C, has secured five patents, Nos. 1,055,819 to 1,055,823 inclusive Patents No. 1,055,821 and 1,055,822 have for an object to provide means for admitting a large volume of air or other fluid between the gas check and the mushroom head without materially changing the construction of the guns now in use Patent No 1,055,819 seeks to provide devices for injecting powdered graphite or other dry material into the bore of the gun with the flushing fluid to coat the surface of the bore to protect it from the action of the hot gases and also to form a dry lubricant which will not be affected by the heat of the gun. The patent, No. 1,055,820, has for an object to provide a positive indicator for showing whether or not the air admitted to clear out the residue of the explosion has performed such function, the indicator also forming a locking device to prevent the opening of the breech mechanism unless the air has entered and performed its work, while the object of the mechanism shown in patent No. 1,055,823 is to provide for admitting air or other fluid to the breech of the gun immediately after the gun is fired and during the first part of the recoil movement of the gun.

The Industrial Need of Technically Trained Men—IV

Why There is Place in Business for Men Technically Trained

By John Ritchie, Jr

THE manufacturing world of to-day depends upon the man who is technically trained. This is becoming more and more evident, and each year the scope of such men is becoming more extended, as specialists, as superintendents and managers and in administrative positions. And at the same time the call for men whose powers of observation and adaptation have been cultivated is on the increase, proof of which is the fact that for every member of the class which graduates this month at the Massachusetts Institute of Technology, whose courses were in mechanical engineering, there have been five opportunities to enter at once into business relations of consequence.

Having been in the past an employer of considerable labor and in the older days and under older methods a manufacturer, the dependence of the business methods of to-day upon the man with technical training is the more striking to me. Further than this, it has been my good fortune to see many young men rise to important places and to realize how much of their success was due to the special education which the technical school gave to them.

There was a time, and this within the memory of men who do not consider themselves old, when the words "conservation" and "efficiency" were not in the merchant's vocabulary, and when business simply cared for itself. The goods were made in leisurely fashion by day labor, the material was bought from hand to mouth, the standard of product was a variable one and the cost was in effect a rough guess. A price was fixed, and the merchant knew that he could sell at a profit. The man who bought a stock of goods or manufactured a storehouse full of them had simply to sit down and wait with the certainty of disposal of them to advantage to-morrow or next week. This was in the lavish days of the development of this great country, when there was plenty for everybody.

That time has passed. The man who is to be successful in manufacturing or selling merchandise or assure profit to himself even in that staple industry, agriculture, must follow scientific methods. He must be ready to compete with others who are keen-eyed and intelligent. If he is a store-keeper of old-fashioned mold, while he is waiting for his goods to sell themselves, his neighbor, who is trained in technical ways, has made improvements, so that the stock of the conservative one is out of date and suitable only for the bargain counter.

There are thus most excellent reasons why business men are turning more and more to the technical schools for young men who are usable at the outset and who may be developed along the lines of the greatest benefit to the product.

The student who has passed his four years at a technical school of the highest grade must have acquired a fundamental knowledge of chemistry and a valuable acquaintance with materials, including those most subject to manipulation. Manufacture consists practically in processes of manipulation. These processes convert the material into products more or less refined, and in the transformations there lies the opportunity for efficiency or waste.

Such schools go further and give a good foundation in mathematics, and the possibility of comparisons by tabulations and graphic diagrams, which are a sealed book to the old-school business man, give a basis whereby economy and efficiency—so far as materials go—may be estimated.

Knowledge of materials means much more in other departments of the business. A man who has knowledge of this kind can test what is offered to him. He has a means of making the raw material conform to a desired standard, and will reap the advantages that must accrue to him in the evenness and reliability of his own product. Further than this, such a man can select between materials when there is a choice. He is fitted to find new materials that may supplant the older ones, and he has the education that will permit him to add advantageous qualities to the materials that he wishes to use.

Materials, important as they prove to be, are but a portion of the story of efficiency, for there is labor and the mechanical plant. Labor is very important, for in an industry producing an article that is not of the highest excellence of finish, it may overbalance the cost of material in the ratio of say three to five. The technically trained man has already acquired the habit of studying, and it is a study to handle men. The success or failure of an establishment may depend upon the fitness of the men to the work they are expected to do. This is realised in technical schools, and already the best of them seek to strengthen their courses by adding something of the direct study of man. But fundamentally the man who studies man is the one who can place his labor most efficiently, and he does it because it is a technical problem.

There is much stress laid on efficiency when it comes to dealing with labor, and there are not a few who, in the rush of newer methods, feel that the workers must be merely machines. Here there is a substantial error, for the handling of labor, like any other acceleration, must be in harmony with the purpose. It is an injury to reduce all laborers to mere automatons. Each industry and each establishment has its own limitations. The man who is properly trained is able to study his own plant as an individual problem and to determine on its own merits, without unfortunate Procrustean standards, where scientific management may be advantageously employed.

Any one can glance over the daily papers and the special ones that have sprung up about all the industries, which may bring opportunity to any man's door, but it is not every one who has the perception to realize what these announcements may mean. Here the training of the technical school in the broadness and keenness of vision that it gives, is of great advantage.

The man with technical education will not attempt to supplant the architect in the latter's specialty, but he will be competent to consider the proper location and arrangement of his buildings, and he will know all about his prime movers and his coal pile. He will be able to rate in their true places the different factors and converge them all to the greatest benefit of the whole establishment. He will be able to estimate the value of heralded improvements and judge whether they are promising ones. He will be able to let go when older methods fail by the newer standards, and he will avoid, what is not so rare in this country, the mortification of seeing an up-to-date rival growing up in his very shadow, and absorbing his business through more efficient management.

Then again, and most certainly not to be underestimated, technical training is of the utmost value in industrial exploration. There is constantly the need of production along undeveloped lines. All kinds of business is groping, so to speak, in semi-obscurity, seeking new fields, new methods, new materials. Here it is that the man with a knowledge of the materials and a knowledge of the methods and with a mind open to catch the latest information that science has to offer him, is bound to win.

Only a quarter of a century ago it was the practical man who had worked up, who was at the head of the concern. It was the bobbin boy or the lineman who had grown to be president. To-day it is the man technically trained, the engineer. He is making his way with all speed. He is yet young. The graduates of the Massachusetts Institute of Technology, the oldest school of the kind in the country, average but thirty-five years of age. But he is growing older and is winning his spurs surely and certainly.

Tests on a 10,000 Horse-power Föttinger Transformer

(Concluded from page 538.)

nection to recall the genesis of the Föttinger transformer After being invented by Dr Föttinger, late engineer of the Vulcan Werke, the transformer was developed by this firm in conjunction with the inventor, and the first installation made in 1909, on board a wharf steamer gave excellent results in permanent operation.

Another installation was made on an English coasting vessel designed for producer-gas motor propulsion This transformer, designed for 150 horse-power, was tested under a maximum load of about 900 horse-power, its maximum efficiency being upward of 88 per cent

At the beginning of the present year an order was received for a big transatlantic steamer on which the huge transformer recently tested is to be installed This has already been followed by an order for another installation A new vessel of 1,700 tons displacement for the North Sea health resort service, which has been ordered from the Vulcan Werke, will be equipped with an engine plant comprising two high speed turbines and two Föttinger transformers, each of about 3,000 horse-power

The remarkable maneuvering capacities of the Föttinger transformer which have been demonstrated by the experimental plant on the wharf steamer, also suggested its use in connection with Diesel motor ship propulsion. Even in this field a success has already been scored, a large Belgian firm having ordered for a motor vessel intended for the Congo, two transformers each of about 550 horse-power This installation shows the special advantage of allowing the non reversible Diesel motors to be operated at low speeds of rotation, i. e., with a remarkable safety of operation, while the propeller shafts, in view of the smallness of the propeller, had to run at higher numbers of turns. The Föttinger transformer thus transmits in this case from a low speed to higher speeds. This type at present is being submitted to continuous tests on the Stettin testing floor of the Vulcan-Werke.

The development of Föttinger transformers for ship propulsion resulted in the adoption of the same type of gear for many applications on land. The first installations for automobiles and locomotives, the latter in connection with Diesel motors, are nearing completion, while a fine iron rolling mill operated by a steam turbine and a Föttinger transformer, has been since September, 1912, in operation at a large industrial works. This plant may also be described as a perfect success, showing as it does a remarkable ease of control and adaptation to the heaviest and most rapid fluctuations in the load of the rolling mill. In fact, the number of turns of the rolling train could be kept constant within 6 per cent to 8 per cent between no load and maximum peak loads. The set can stand overloads up to about 2,800 horse-power on the secondary shaft and is driven at an average ratio of 1 4.8. The efficiency of this transformer can be kept practically constant at about 85 per cent within wide limits.

Apart from these large units some smaller units have been designed for the operation of blowers, lifting devices, etc.

All these applications conclusively show this type of transformer to possess a remarkable safety of operation, reached by no other gearing, up to the highest outputs and speeds of rotation. In fact, the transformer has now definitely emerged from its experimental stage and is ready for industrial exploitation on a huge scale.

Bacteriology and Your Health

(Concluded from page 541.)

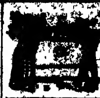
ventive, however, a number of infections have been encountered in which the injection of dead bacteria has not yielded satisfactory results, and in animal experiments some of these infections have been successfully immunized against by the use of living bacteria. Ever since this form of treatment was introduced, at-

tempts have been made to apply it to the cure of tuberculosis, but the results have been most discouraging. The most recent of these attempts, that of Friedmann, is now on trial His bacterial vaccine differs from those heretofore employed in that he uses living instead of dead tubercle bacilli. It will be recalled that Pasteur sought to produce a very mild attack of anthrax in his animals by using anthrax bacilli which had been artificially weakened. Similarly, Friedmann makes use of tubercle bacilli obtained from a turtle, which, through adaptation to the turtle, have been so changed as to be no longer virulent for man. Whether this form of treatment will prove to be successful or not remains to be seen; the results thus far are not encouraging.

In this connection it may be well to remember what has already been said concerning the strict specificity of the action of all these substances. Injections of typhoid bacilli are of no avail in the treatment of dysentery, or of cholera Similarly in tuberculosis nothing can be hoped for from injections of bacilli merely resembling tubercle bacilli, and there is some question whether these bacilli from the turtle really belong to the same family as the true tubercle bacilli which cause consumption. But even if they are true tubercle bacilli, it by no means follows that this represents the "cure" scientists have so long been seeking From what has gone before it is obvious that treatment with specific sera and vaccines is premised on the assumption that the development of antibodies represents the cure of the disease. This assumption, however is open to criticism, for experience has taught us that with the development of the antibodies, only one of the curative factors has been brought into existence To be sure, in many infections, the antibody is so important that the other factors are practically negligible. In other cases, however, something more than the mere presence of the specific antibodies is apparently needed in order to cure disease. The poor results thus far obtained with various forms of serum and vaccine treatment in tuberculosis make it likely that important causative factors remain unaffected by this form of treatment.

In concluding this brief sketch it may be added that a delicate but rather complicated serum reaction is now made use of in the diagnosis of venereal infections, and has thrown a great deal of light on the cause of such diseases as locomotor ataxia and general paresis. Another serum test is extensively used in the examination of blood stains for medico-legal purposes, by its use human blood stains can positively be differentiated from those of the lower animals. The same test is used in the examination of sausages and the like in order to detect horse or dog flesh A number of observers have devised methods of diagnosing cancer by means of serum reactions, but up to now none of these has proven reliable All in all, these immunity studies have proven one of the most fruitful fields of medical research.

Three Patents for Steel Improvements.—Benjamin Talbot of Woodburn, Darlington, Eng., has secured patents Nos. 1,055,831, 1,055,832 and 1,055,833, relating to improvements in steel. The patent No. 1,055,831 is for a process of treating steel ingots for the purpose of eliminating or reducing "pipes" or cavities. In carrying out the process, the ingot is stripped from the mold while its interior is still fluid and the ingot is heated to soften its outer strata and then squeezed to reduce its cross sectional area at the top. The patent No. 1,055,833 is along the line of No. 1,055,831, with improvements including the rolling of the ingot into the shape of a rail. The patent No. 1,055,832 makes a steel rail or other shape with a purified central part lower in carbon than the outer strata, thus improving the structure to free it from flaws and defects and give it a uniformly tough interior lower in carbon than the outer part.



NEW BOOKS, ETC.

The Interpretation of Dreams. By Prof Sigmund Freud, LL.D Authorised Translation of the Third Edition With Introduction by A A Brill, Ph D, M D New York The Macmillan Company 8vo, 510 pp

The publication of an excellent translation of Freud's 'Interpretation of Dreams may be regarded as an event for English and American students of psychology who are unable to read German with ease No psychological theory has been advanced in recent years which has attracted so much attention and which has roused so much discussion as Freud's theory of dreams It is almost impossible to pick up a German psychological periodical of the last five years without finding in it at least one reference either strongly approving or disapproving of Freud's views. The mere facts that the European psychological world is divided into two camps with respect to the acceptance or rejection of Freud's doctrines, shows that we are dealing with a momentous announcement

In the space of such a brief review as this it is difficult if not impossible to present even a cursory survey of Freud's studies. Freud holds that dreams have as their innermost meanings wish-fulfillment and wish-fulfillment only His opponents think fears, anxieties and antipathies are equally primitive and equally prone to appear as the inner meaning of dreams. Moreover they are inclined to differ with him and his followers on the point that the wishes *forming the dream thoughts* or latent contents of dreams are always of a sexual nature Freud himself does not go so far as this, although he is inclined to think it probable This would follow from the fact that he approached the problem of dreams from the side of abnormal psychology Having been led by his studies on hysteria to a new theory of the nature and workings of the unconscious mind in this class of mental disorders he then found that the same theory could be made to include the dreams of normal persons, the dreams corresponding with the symptoms of the hysteric in being disguised fulfillment of repressed and therefore unconscious wishes or tendencies And since he found that these wishes in the case of the hysteric were invariably of a sexual nature dating from early childhood he was tempted to the view that the wishes fulfilled in dreams are generally sexual wishes and his disciples contend that the results of psycho-analysis applied to thousands of dreams bear out this theory There can be little doubt that sexuality taken in the wide sense in which the Freudians use the term plays a much more important part in the mental life of the individual and of the race than is generally recognized Freud has made a most valuable contribution to psychology in emphasizing its significance and supporting his theory by such a wealth of concrete facts

La Mer. Fascicules 16 à 20 Paris Librairie Larousse, 1913

These installments of La Mer take up the subjects of torpedoes torpedo boats submarines of all types life on board a warship organisation of the French naval personnel description of a merchant vessel both of the sailing and steaming types the launching of a ship description of a modern ocean liner a deep-sea fishing vessel deep sea fishing in general and life of the deep-sea fishermen The articles are all written in a popular vein and yet seem to be quite authoritative.

The Soldier's Foot and the Military Shoe A Handbook for Officers and Non-commissioned Officers of the Line By Edward Lyman Munson, A M M D Major, Medical Corps, United States Army Fort Leavenworth, Kansas, 1912 8vo, 147 pp, illustrated

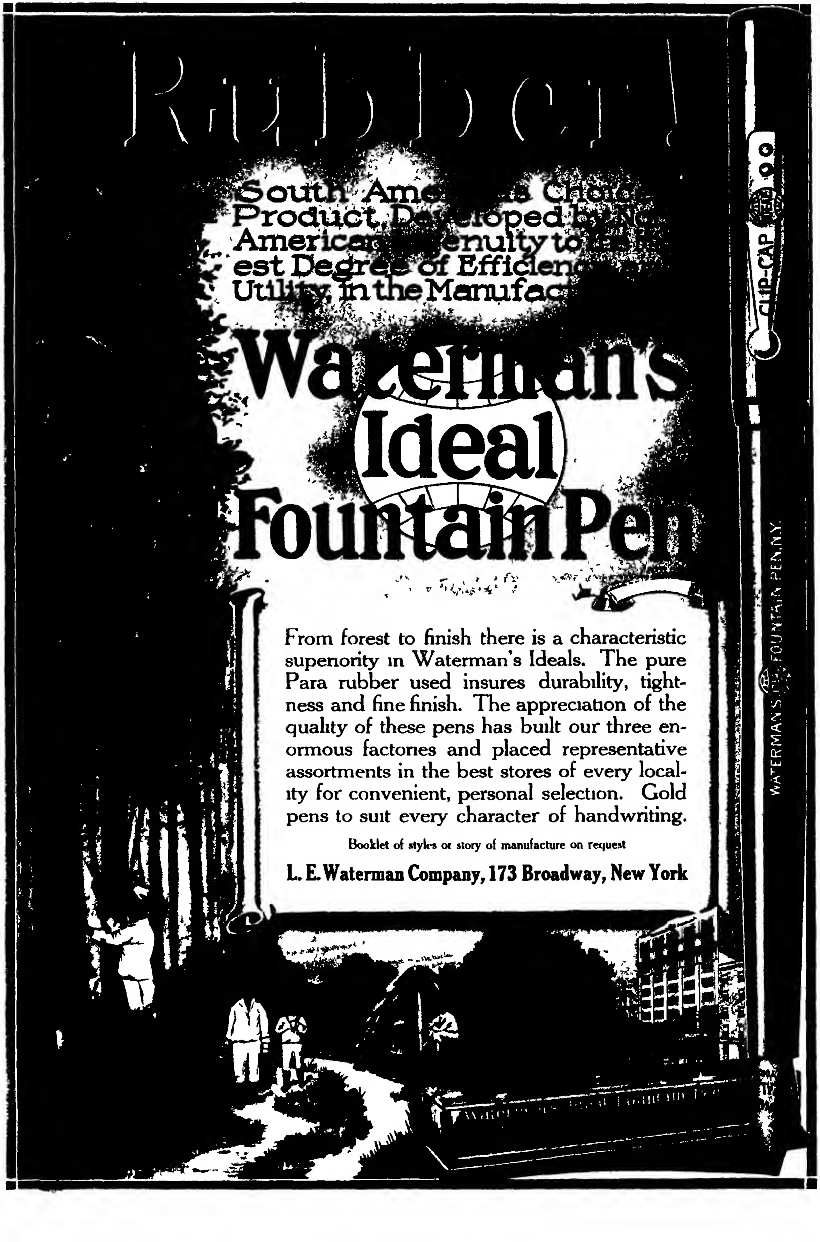
Major Munson was president of the Army Shoe Board which made a critical study of the feet of some two thousand soldiers In the chapter on The Anatomy and Use of the Foot the intricacy of this much-abused member is most clearly established and the result of interference with the normal anatomical relations of even its minor mechanism is pointed out The final chapters on the care of the feet and of the shoes make for improved conditions, and might be profitably perused not only by military officers for whom the work is primarily intended but also by letter carriers, policemen and the walking public.

Elements of Hydraulics A Text-Book for Secondary Technical Schools By Mansfield Merriman New York John Wiley & Sons, 1912 12mo, 156 pp Price, $1 net

The aim of the book is to impart a knowledge of hydraulics to those students who have only high school preparation and the higher branches of mathematics have not been drawn upon At the same time most of the essential principles and methods have been covered although the limitations of the students for whom it is written have made it necessary to treat certain topics rather briefly and to ignore some few others altogether

Boiler Explosions, Collapses, and Mishaps By E J Rimmer, M Eng, B Sc With an Introduction by A A Hudson, Esq, K C New York D Van Nostrand Company, 1912 8vo, 135 pp Price, $1 75 net

The work is a summary of the causes of boiler explosions and the recommendations for their prevention contained in the reports of the British Board of Trade from 1882 to 1911. There is also a statement of what the British law requires of boiler users and of their liabilities under the boiler explosions acts. It is in the first part of the work that American interests would center and here the information concerning the use and misuse of boilers should certainly prove of benefit and serve as a preventive to mishap.



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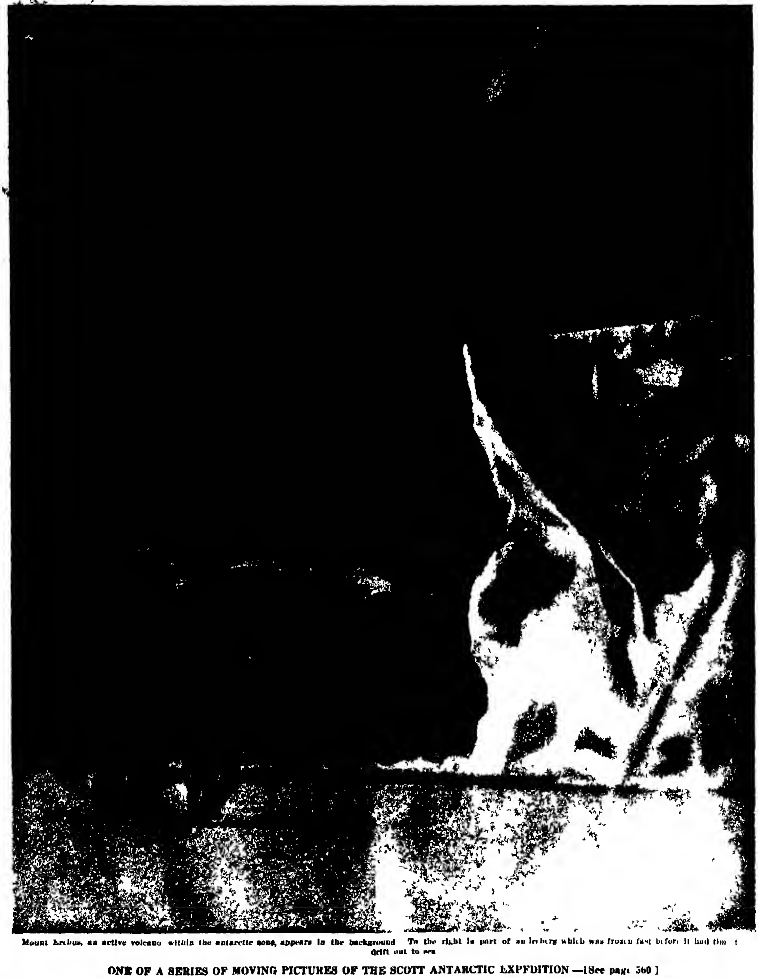

Mount Erebus, an active volcano within the antarctic zone, appears in the background. To the right is part of an iceberg which was frozen fast before it had time to drift out to sea

ONE OF A SERIES OF MOVING PICTURES OF THE SCOTT ANTARCTIC EXPEDITION.—[See page 560.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

The Need of an Automatic Stop

FATE seems to have singled out the New York, New Haven and Hartford Railroad Company to teach the need of an automatic train stop. In the course of the last two years—from June 8th, 1911, to June 12th, 1913—there have been no less than thirteen accidents on that unfortunate road—thirteen accidents in which forty-eight persons were killed and hundreds injured. The sheer carelessness of engineers was responsible for part of this loss of life, and spreading rails, short crossovers, inoperative signals and other defective equipment for the rest. The last accident, a rear-end collision in which six were killed, was also primarily due to defective equipment.

In his testimony at the Coroner's inquest, the engineer who is held responsible told a story which, if substantiated, absolves him of carelessness. Absolutely unfit though he was to drive a fast passenger locomotive—he was a promoted fireman who had handled a powerful express engine only a few times—he had been placed in the cab of a new and exceptionally heavy Pacific type engine, the airbrakes of which had been reported defective. He testified that he obeyed both the distant and the home signals set against him before he reached the scene of the accident, by shutting off his steam and applying his airbrakes. Either because the airbrake equipment was not adapted to this 200,000-pound locomotive and the eight cars behind it, or because it was out of order, the train rushed on. The engineer sanded the track, blew his whistle and finally tried to reverse his power, but was unable to do so because of his physical inability to move the stiff reversing lever sufficiently. The brakes of the rear cars apparently held better than those of the forward cars.

Something can be learned from this disaster. Engine builders must obviously provide a more easily operated reversing gear. Passing over the fact that the air brakes seem to have unaccountably failed, and that instead of a steel coach, a wooden parlor car had to bear the brunt of the shock, with the familiar results on which we have repeatedly commented, again the necessity of relying on an automatic apparatus, which will act independently of an engineer, is driven home with tragic force.

No doubt the New Haven road's interest in automatic stops, evidenced by its widely advertised ten thousand dollar offer for a suitable appliance, will be heightened by this latest catastrophe. The railroad as well as inventors in general will surely profit by a close study of the circumstances that occasioned the collision. We must admit that we know of no automatic stop, otherwise unobjectionable, which would have averted this particular collision, for the reason that most stops do not shut off the power, but simply act on the air brake system and sound or display a signal. Only a stop which would reverse the power would be of any service when airbrakes prove inoperative at the crucial moment.

Agriculture in the High Schools

THE plan of teaching agriculture in the secondary schools is spreading over the country with remarkable rapidity—so much so, in fact, that it is very difficult to find enough teachers qualified to give such instruction, to say nothing of the lack of suitable equipment and other material difficulties. Agricultural colleges are now a familiar institution, and agricultural instruction in the common schools is no novelty. On the other hand, agriculture in the high schools may still be regarded as experimental, though it will soon cease to be so. This subject has just been investigated and reported upon by the United States Bureau of Education. From the report in question it appears that as recently as the school year 1906-07 less than one hundred public secondary schools, either special or general, gave agricultural instruction, even by means of simple experiments. In 1910 about 1,800 schools reported that agriculture was taught as a separate study in the high school department. It is true that in some of these cases the term "high school" was made to include the upper grades of the grammar school, but even making allowance for this fact it remains evident that there has been an immense increase in the number of true high schools in which distinct courses in agriculture are offered.

The first tentative steps in this direction date from the period between 1825 and 1860, during which there were a few attempts to introduce agricultural instruction into the ordinary academies, as well as some purely vocational experiments. From 1865 down to a very recent date the land grant colleges, established under the famous Morrill act of 1862, in addition to their regular college courses, did much work of a purely secondary school grade. The University of Minnesota in 1888 set off this work into a high school department, an example very largely followed since. About 1907-08 a large number of special agricultural high schools were established, but this practice has now declined somewhat in favor of the plan of granting State aid for the support of departments of agriculture, or of agriculture and home economics, sometimes including manual training, in high schools already in existence.

Another token of progress is the increasing length of these high school courses in agriculture, which at the outset were mainly limited to one year. In the academic year 1911 to 1912 agricultural courses of two or more years were maintained locally in about 135 public schools, and by State aid in 175 more. This is in addition to 50 or more separate special schools of agriculture and 34 secondary schools attached to the land grant colleges.

Lack of teachers has been the great difficulty ever since the introduction of special agricultural courses into the high schools began. When the textbook was supplemented by simple schoolroom experiments, a short summer course was sufficient to piece out the general training of the science teacher or the practical farm experience of the principal or superintendent. Now, however, with high school courses extending over several years, and including the more elaborate field and judging operations, such meager training is inadequate. Within the last two or three years the idea has spread rapidly of establishing professorships of education in agricultural colleges, and professorships of agriculture in colleges of education (the general normal schools). Moreover, there are now greatly improved facilities for preparing instructors for high school agriculture in at least 37 of the land grant colleges, thanks chiefly to the so-called "Nelson amendment" to the agricultural appropriation bill approved March 4th, 1907, which provides that a portion of the funds appropriated thereby, amounting now to $25,000 annually, may be used by the land-grant colleges for the special preparation of instructors for teaching the elements of agriculture and mechanic arts.

The textbook problem has been fairly solved during the past three years, with the appearance of texts especially written for secondary schools, including some on particular branches of agriculture for use in the advanced courses.

An Optical Test for Mechanical Strains

THE modern engineer has a wide field from which to choose in devising methods of testing materials; the physicist is ready to place in his hands the most refined means of experimental observation. Thus, for example, it may often be sufficient to know the net result, as measured at the points of application, of a system of stresses exerted on a given structure or machine part. But how much more valuable the knowledge gained if we can actually look into the very core of the material of construction, and *see* the lines of strain. A simple application of physical principles enables us to do this. For a transparent body, such as glass, under strain, no longer allows the passage of light indifferently in all directions. It becomes "optically active," as the physicist says, and rotates the plane of polarized light in a measure depending upon the magnitude of the strain. The effect can be rendered observable to the eye by the aid of a Nicol's prism. In this way a glass model of a structure or sample to be tested gives us a valuable insight into the distribution of strains, primarily in the model, and by [illegible] itself. It is true that the properties of glass will differ more or less widely from those of the materials actually employed in construction. While this will affect the results in their quantitative relation, they remain true qualitatively.

A series of tests of this character has been performed by Prof. E. G. Coker of the City and Guilds of London Technical College, and was reported upon before the sixth congress of the International Association for Testing Materials. An account of these experiments will be found in this week's issue of our SUPPLEMENT. Prof. Coker applied the method in particular to the examination of cement briquettes such as are employed in the usual strength tests. He shows that the ratio of maximum stress to mean stress varies from 1.70 for the American standard to 1.75 for the English and 1.95 for the continental standards, respectively. These measurements indicate the want of agreement in the stress distribution in the several standard types, and show what an important factor the form of the briquette is. This is just one application of a method which seems destined to find a very general field of utility.

Genetic Research in Great Britain

WRITING of "The Progress of Mendelian Studies in Great Britain," in the *Monthly Bulletin of Agricultural Intelligence* of the International Institute of Agriculture, Prof. R. C. Punnett of Cambridge University shows how intense the activity has become in this comparatively new field, and what valuable results have already been achieved by British investigators. It happened that the well-known work of Bateson and his colleagues, at Cambridge, coincided with the rapid rise of the School of Agriculture of the University, so that the new knowledge was immediately applied to practical purposes, especially in Prof. Biffen's experiments in crossing cereals. Already improved wheats have been developed and placed at the service of British farmers. The British government now subsidizes the researches in plant breeding at Cambridge, which have been extended to plants other than cereals, especially fruit trees. One important undertaking in progress here is the development of a potato naturally immune from *Phytophthora infestans* (potato blight), and success appears to be near at hand. The Cambridge experiments also extend to poultry and sheep. The best equipped British institution for the study of genetics is now the John Innes Horticultural Institution at Merton, near London, started in 1909 with Prof. Bateson, formerly of Cambridge, as its first director. Mr. Hurst, one of the pioneers in Mendelian studies, has established an experimental station at Burbage near Leicester, where one of the most interesting experiments aims at the production of a pure race of steeplechasers, i. e., horses with a special aptitude for hunting. Genetic research is also carried on by Prof. Keeble, at University College, Reading, especially on primulas; by Mr. Staples-Browne, of Bampton, near Oxford, who is working with pigeons, and by Dr. Trow of Cardiff. In Ireland, Prof. Wilson of Dublin has lately brought together a number of records dealing with the heredity of coat-color in cattle and horses, and with the milking capacity of cows. Scotland has made a start by creating a lectureship in genetics at the University of Edinburgh.

Investigating Atmospheric Pollution

A COMMITTEE has been formed with headquarters at London for the purpose of standardizing and co-ordinating the diverse methods in use in various parts of Great Britain for determining the degree of pollution of the atmosphere by dust and soot.

Undertakings of this character include the investigations conducted by the *Lancet* in 1911 upon the soot fall of London, Prof. Cohen's experiments at Leeds; and those of the Glasgow Corporation. Heretofore no attempts have been made to introduce uniform methods, so that the measurements made in different places are not comparable. The committee has now decided to recommend two methods.

One of these methods is that successfully used in the inquiry conducted by the *Lancet*, in which a form of enlarged rain-gage having a catchment area of four square feet received all rain, soot, and other deposits, and in which a large bottle was provided to collect them, so that they could be analysed each month and the amount of solids estimated.

In the second method, which is much more complicated than the first, a measured volume of air is drawn through filter paper in a special apparatus, and the degree of discoloration of the paper measured. This method, which has been in use in Glasgow for about two years, is intended to give measurements of the solid contents of the air from day to day, and from hour to hour.

Engineering

Investigating Railroad Accidents.—A careful study of all accidents, no matter what their nature, has been made by the Pennsylvania Railroad, during the past year, and it has been found that probably 75 per cent of them could have been prevented if the employees had exercised special caution. This has led to the publication of a booklet entitled "*Safety Hints and Suggestion for the Prevention of Personal Injury Accidents*," by which it is hoped to educate the employees to a disposition to be careful, and to develop in each individual a sense of personal responsibility, not only for his own safety, but for that of his fellow employees as well

Largest Diesel Engined Vessel.—The ship "Hagen" which is the largest vessel in the world to be propelled by Diesel oil engines, recently made her trial trip in the lower New York Bay The vessel which was built for the Standard Oil Company measures 400 feet over all and has a displacement of 8,350 tons. She is equipped with two 6-cylinder Diesel engines of 2-cycle type, adapted to develop 2,400 horse-power at 140 revolutions per minute. At sea the steering engine is driven by compressed air When nearing port, steam from a donkey boiler is used in the steering engine The vessel is lighted by electricity and the living quarters are heated by a hot-water system, the water being heated by the main exhaust of the engine. During the test the vessel ran at about eleven knots.

Death of Charles Henry Cramp.—The former head of the shipbuilding firm of William Cramp & Sons died at the home of his son in Philadelphia, on June 6th, at the age of 85. He was the son of William Cramp, who founded the firm of William Cramp & Sons on the Delaware in 1830. Upon the death of William Cramp in 1879, Charles Henry Cramp became the head of the firm He did much toward the building of the American navy As far back as 1879, he built four vessels for the Russian navy The battleship "Maine," successor to the "Maine" that was destroyed in Havana Harbor, was built by the Cramps in 1902. It was Mr. Charles H Cramp who suggested the "penalty system" by which a certain sum is deducted for every unit of power below that guaranteed in the contract. William C Whitney, then Secretary of the Navy, accepted this suggestion and also introduced a premium system by which certain sums are paid in addition to the contract price if the performance exceeds the guarantee in the contract.

Air Testing in Submarines.—In order to determine the amount of carbonic-acid gas in the air of submarines, a device has been developed in Germany known as the "aeronome " It consists of a cylinder of nutwood about 4 inches in diameter and 4 inches high. It carries a scale for the liquid in a U-shaped glass tube which indicates the carbonic-acid content of the air The cylinder is closed by an air-tight lid Through the lid passes a thin tube with locking wheel which transmits to the outside air the air tension produced on closing the cylinder The nickel-plated inside wall and bottom of the cylinder are lined with moist-filter paper The air within the cylinder which is to be tested communicates with one branch of the U-tube while the other is open to the outside air In the lid of the cylinder is placed a cartridge for absorbing carbonic acid. This cartridge remains closed while the apparatus is opened to admit the atmosphere that is to be tested, then by screwing down the locking wheel above referred to, the cartridge is made to fall from the lid to the bottom of the chamber, and as it absorbs the carbonic-acid gas, the volume of air in the chambers is reduced by an amount which is indicated in the U-tube. A single cartridge may be used for ten ordinary air tests.

Air Resistance in Simplon Tunnel.—The question of air resistance in the Simplon Tunnel is discussed by a leading Swiss engineer, B. Kilchenmann. The energy required to run trains in the tunnel upon the electric line is 35 watt-hours per ton-kilometer, including the weight of the locomotive, and this high figure is due to air resistance within the tunnel. The tunnel is 14.7 feet wide at the rail level and 18 feet high from ties to roof, the area of section being 250 square feet. The two large electric motor-driven blast fans at the Brigue end send in 3,530 cubic feet of air per second, and there are two corresponding exhaust fans at Iselle. A train allowed to run down the road by gravity on the 7 per 1,000 maximum gradient between the tunnel ends cannot exceed a speed of 60 kilometers (37 miles) an hour, even when going in the same direction as the air current, for the action here resembles that of a dash-pot. He compares the results obtained within the tunnel with those of the train when run in the open air, and finds that at a speed of 25 kilometers (15.5 miles) an hour a train running in the tunnel with the air draught encounters less resistance than in the open air, being propelled by the air current. At speeds over this amount, the resistance in the tunnel is greater than in free air. Such resistance due to air will certainly be lessened when the second and parallel tunnel comes to be built, for the pressure will then be balanced between the two ends of the train, as the tunnels will be 55 feet apart [illegible] and have numerous cross galleries.

Electricity

Long Distance Wireless Telephony—According to a press report wireless telephonic communications have successfully been established between Berlin and Vienna, a distance of 355 miles. The German station was at Nauen and the Austrian station on the roof of the Technological Industrial Museum in Vienna.

Wireless Station in the Arctic.—The expedition which will leave New York on July 2nd or 3rd to explore the Arctic continent known as Crocker Land, is to carry with it a powerful wireless telegraph equipment. The generators will be operated by kerosene engines and a Telefunken wireless system will be employed, having a range of 2,000 miles. The wireless apparatus will be installed on the north side of Flagler Bay This will enable the expedition to keep in touch with civilization and it will also permit of experiments with directed Hertzian waves under the ideal climatic conditions of the Arctic At Flagler Bay there will also be established a seismographic station.

The Output of Electrical Steel.—The *Comité des Forges de France has compiled the following table of* the world's output of electrical steel

	1909 Tons.	1910. Tons.	1911 Tons.
Germany and Luxemburg	17,773	36,188	60,654
Austria-Hungary	9,048	20,028	22,867
United States	13,762	52,141	29,105
France	6,515	13,445	13,850
Sweden	591	431	2,034
Total	47,689	122,233	128,510

It will be observed that in all the countries there has been a steady increase in output except in the United States where the output for 1911 is 44 per cent less than that of 1910

The New Electric Searchlight Projectors, made by the Allgemeine establishment of Berlin, are among the most powerful yet to be produced, and their candle-power, which is too high for measurement, can only be reckoned in hundreds of millions. What is striking is the new method of regulating the arc The large carbons are now moved back and forth by small electric motors and suitable gears, current being applied to the motors by a set of relays which work according to the current taken by the arc, thus securing an automatic adjustment of the arc length in the best way The base of the projector contains other motors for all the searchlight movements, and a distant lever control is so designed that turning the lever in all directions makes the projector also follow these same directions for pointing the beam. These searchlights will carry several miles and still give light enough to read by.

The Vibrating Reed Method *of showing the frequency* of alternating currents is meeting with much favor at present on account of its simplicity and accurate working As will be remembered, it consists of a set of say ten small tongues of spring steel mounted in line before a long magnet carrying the current, each being tuned for a different pitch between 45 and 55 per second. Only one tongue can vibrate for any given pitch of the current, and the free and slightly upturned end of the reed expands out in an apparent broad line so as to be clearly seen when it vibrates All the reed ends are on a dial in a line numbered in series so that when the current is at the standard rate of 50, for instance, this numbered reed is seen to vibrate. By using the reeds to make battery contacts, we can signal any over or under frequencies to a distant point. Another use is to mount the new Hiltebrand dial or recorder device over an office desk, connected by wire to the dynamos, so that the chief engineer sees just how the machines are running

Electric Heat-storage Stove.—Perhaps the development of electrical cooking has not been greatly encouraged for the reason that such apparatus would be employed at the very time when the load of the central station was highest. Recently an electrical stove has been invented which the central station manager should welcome for the very reason that it calls for a low rate of current continuously or during the period when the central station is not burdened with a peak load The stove consists of a block of iron imbedded in heat insulating material Within this block is an electrical heating unit. The surface of the iron block forms a smooth plate on which a cooking utensil may be placed. But normally when the stove is not in use it is covered by a lid, also filled with heat insulating material. As there is practically no outlet for the heat generated by the heating unit, the iron block is steadily heated and rises in temperature until the cover is removed for a cooking utensil to be substituted. After one dish has been cooked, the cover is applied to the stove again and it is permitted to store heat until the next dish is to be cooked As compared with the ordinary disk stove the heat-storage stove uses very little current.

Science

A Remarkable Natural Bridge in the Philippines, recently discovered by Mr Paul R. Fanning, is described in the *Philippine Journal of Science*. Although only about thirty miles south of Manila, it is believed never to have been visited before by white men, and it is the first large natural bridge reported in the Philippines. It is on the Lucsuhim stream, a couple of miles west of Silang The stream runs through a cañon and the space beneath the bridge forms a tunnel, about 35 feet broad and some 250 feet long The floor of the bridge, now about 130 feet above the stream, bears evidence of having once been the bed of the latter

Minute X-ray Pictures.—M Pierre Goby appears to be the first to obtain photographs of very minute specimens by the use of X-rays, such as diatoms and the like which have about the size of a grain of sand This he does by placing the specimens directly upon a photographic plate and allowing a perfectly vertical beam of the rays to fall from a bulb above, through a special tube so as to properly direct the rays on to the object In this way he secures a very minute photograph of the interior structure of the specimens, and this can be enlarged many times so as to obtain a large view in which the structure is clearly visible.

Carnation Food.—The mere chemical analysis of a fertilizer does not always afford the proper measure of its benefit to the plant. Nitrogenous manures of various sorts may furnish the same amount of nitrogen and yet produce widely different results with flowers This has been clearly shown in one of the largest greenhouses in this country where fish guano was tried as a carnation fertilizer with astounding results In rapidity of growth, strength of stem and beauty of bloom the plants so treated outclassed those fertilized by other manures Fish scrap is worked up into fertilizer in large quantities along the Middle Atlantic coast and to some extent along the Great Lakes. The cost is not unreasonable In all probability there is some active plant stimulant in the fish that accounts for the results. Methyl amine is found in fish and this may be the active element.

The Cooling Power of the Atmosphere depends upon other things than its temperature and the temperature of the body cooled Thus, the wind is an important factor, as is the radiating power of the body in question. Dr J R Milne, of Edinburgh, has described to the Scottish Meteorological Society an instrument for measuring the rate of cooling from a standard surface maintained at a fixed temperature of 98.4 deg Fahr This is "blood heat," and appears to have been chosen in order that the readings of the instrument may be a measure of analogous effects upon the human body The device consists of a cylinder of thin copper, insulated except for its hemispherical top with plaster of Paris It is filled with paraffin oil, and the amount of electrical energy necessary to keep the oil at blood heat is continuously recorded Hence may be deduced the loss of heat calories per square centimeter per second Dr Milne calls his device the "psuchralnometer" (Why not "psychrainometer"?) It is quite similar in principle to Frankenhauser's "homœotherm" (*Zeitschrift fur Balneologie*, vol 4, 1911, pp 439-441), as well as to the cruder 'depreditometer" of A Piche and several earlier instruments.

The International Meteorological Committee met in Rome, April 7th to 12th, and was attended by the directors of official meteorology in France, Portugal, Holland, Sweden, Switzerland, Italy, Denmark, Russia, Canada, Prussia, and Great Britain The questions disposed of included some that have aroused much controversy throughout the meteorological world during the last two or three years. At the request of the International Institute of Agriculture the subject of agricultural meteorology was fully canvassed, and a special commission was appointed to undertake further investigation in this line Dr Hergesell, president of the International Commission of Scientific Aeronautics, gave an interesting account of the work recently done in aerology It is proposed to arrange for a large number of upper-air soundings at far northerly points in 1915 for comparison with those which are to be made by Amundsen during his drift across the north polar basin. In this connection the Russian government will probably carry out upper-air observations at Yakutsk and Verkhoyansk, in Siberia, and will perhaps send aerological expeditions to Nova Zembla and the mouth of the Lena. The German scientific station in Spitsbergen will probably be kept open long enough to co-operate in this undertaking, and it is likely that Stefansson's Arctic expedition will contribute its part. The much-mooted question of using dynamic units of pressure in meteorology was settled provisionally by the decision to publish the results of aerological observations in both millibars and millimeters. International agreement was finally reached on the question of uniform storm signals, those recommended at the two conferences held in London were adopted, with the exception of the night hurricane signal. The next international meteorological meeting will be a "conference," to be held in 1915, probably in Holland.

Thirty-six Hours Under Water

A Submarine Propelled by Gasoline Engines While Submerged

By Charlton Lawrence Edholm

LAST week the newspapers contained telegraphic dispatches sent directly from a craft at the bottom of Long Beach harbor, California. The vessel was a submarine that was endeavoring to establish a world's record for submergence by staying down thirty-six hours as against the record then held by the "Octopus," which in 1907 remained under water twenty-four hours. The new submarine sank at 11 A. M. on Monday and promptly at 5 P. M. Tuesday rose to the surface with its new endurance record. It contained a crew of six men who were not in the least affected by their long imprisonment. Throughout the test they were able to communicate with the outside world by means of a cable.

The submarine is a 75-foot craft with 7.5-foot beam and weighs 43 tons. It differs materially from the more familiar types, the most striking innovation being the position of the propellers near the bow. It is claimed that by thus pulling instead of pushing the vessel through the water the tendency to dive too abruptly is eliminated.

The inventor is John M. Cage, who has been studying the building of submarines for many years and believes that his model will prove superior in many respects to those now in use. He claims a speed of from seventeen to eighteen knots for his vessel running submerged with a maximum speed on the surface of about 16 knots. There are various automatic controls for ventilating, regulating the depth, maintaining stability and steering, but the details of these devices are withheld pending the issue of patents. The nature of some of them may be observed in the photographs, as for instance the rudder, which resembles that of an aeroplane, the projection along the top of the craft resembling the dorsal fin of a fish, etc.

A very important feature is the elimination of storage batteries, as the vessel is operated by gas engines, used during submergence as well as while on the surface. Two gasoline engines are used, each developing 110 horse-power. By a device of unique construction, the exhaust from the engines is expelled from the submarine while running under water, and an advantage of this system is that greater speed is obtainable while submerged than when running on the surface. Of course the use of gas engines under water necessitates the operation of a device to discharge the exhaust so completely that the air will not be vitiated, and the inventor's tests seem to indicate that he has solved that problem.

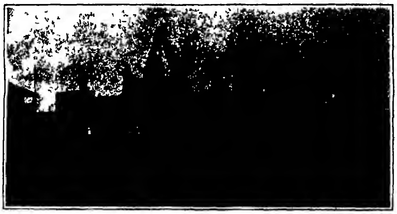
An air compressor and flasks for storing up 30,000 cubic feet of air with a pressure of 3,000 pounds form an essential part of the new submarine's equipment.

On March 20th a test run was made at Long Beach with the following result: The boat was submerged to a depth of eighteen feet in a thirty-foot depth of water and was found to respond perfectly to her horizontal and vertical rudders, sinking bow first or stern first at will of the inventor or rising and sinking on even keel. Three men made the initial trip: Mr. Cage, Chief Engineer Allen Hoar and Assistant Engineer Clifford Hauenstein. Later in the day, some newspaper men were taken on a trial trip, and they also reported the success of the engine operations and the purity of the air while they were submerged and the absence of gasoline fumes. Of course no tests for speed were made while in the harbor, but it is believed that records in that line will be made owing to the novel features in the general outline, position of the propellers and devices for securing maximum power from the engines.

Regarding the feature of elimination of gas fumes, Mr. Cage says: "By our mechanical means, we have run the engines, exhausting overboard against a back pressure of 12½ pounds, all the while maintaining a vacuum on the engine exhaust of 23½ inches. We have also run the engines under water with the valve on the outboard exhaust closed down, until the gage showed a back pressure of 150 pounds, corresponding to a depth of water of over 300 feet, and at that pressure run the engine for thirty minutes, always showing a vacuum of six inches on the engines. This test showed no appreciable load on the engines."

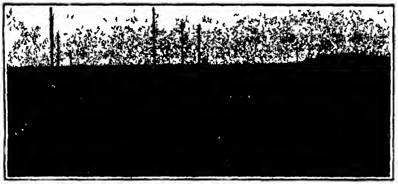
The novel craft was built at a cost of about $70,000, and was constructed partly by the Craig Ship Building Company at Long Beach, and completed in the yard of the Los Angeles Submarine Boat Company.

In addition to its value as a war craft, Mr. Cage and his associates believe that there are great commercial possibilities in a vessel designed for the recovery of sunken treasure, and of course records are extant of countless millions of dollars in gold that have been lost in wrecked ships, and in many cases the position of the wrecks is known with sufficient accuracy for a submarine to locate them. Regarding this, the inventor says: "We propose to build a boat capable of being submerged to a depth of 1,000 feet with perfect safety, and with a lifting capacity of 75 tons. With grappling hooks, or clam-shell dredges, and with large and powerful arc lights installed in the bottom of the boat, it would be a feasible undertaking for men within the submarine to work effectively in recovering sunken treasure."



Constructing the hull of the "Cage" submarine.

The completed craft. Note the forward propellers.



Afloat at Long Beach Harbor, California.

The engine room showing the two 110 horse-power gasoline engines.

Human Barometers

MUCH has been written on the relations between weather and disease, and in medical literature there is no lack of carefully drawn curves showing the varying prevalence of particular diseases, the rise and fall of mortality, etc., side by side with others indicating the march of one or more of the meteorological elements. There is, however, one phase of this subject that has been strikingly neglected. Many human beings are notoriously sensitive not merely to the weather of to-day, but also to the weather of to-morrow. Arthritic, rheumatic and neuralgic patients need no barometer or weather map to tell them when bad weather is approaching. Old wounds give trouble at such a time, and members long since amputated reassert their power to cause pain. These phenomena are so well known that it would be sheer fatuity in any scientific man to deny them, merely because he cannot understand them, yet strangely enough they have been the subject of very little systematic investigation.

A special case under this general head is the extreme sensitiveness of some persons to the approach of thunderstorms. The pathological condition experienced by such persons before a thunderstorm must not be confused with ordinary dread of thunder and lightning. In fact, this condition often comes on before there are any ordinary indications of the storm's approach, and the symptoms commonly subside before the storm is over. Attention was called to this condition some years ago by Dr. G. M. Beard, in Beard and Rockwell's "Medical and Surgical Electricity," and it was given the name of "astraphobia." Cases of its occurrence are, however, familiar to almost everybody. The symptoms of the complaint seem to include all kinds of nervous manifestations, going on quite often to extreme nausea, and physical prostration.

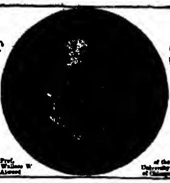
One turns naturally to German literature for the elucidation of almost any scientific question that lies off the beaten track, but in this particular case without much satisfaction. It is true that W. Hellpach's unique book "Die geopsychischen Erscheinungen" (Leipzig, 1911) gives quite an elaborate account of astraphobia (without calling it by name), but this work raises many more questions than it answers. Other German writers have dealt with analogous problems. For example, H. von Ficker has attempted to explain the physiological effects often felt before the arrival of the Swiss foehn, as due to the rapid small fluctuations of the barometer. Finally, in the *Zeitschrift für Balneologie* for January 15th and February 1st last, there is a most suggestive article by Dr. Martin Farkas, of Budapest, on "Wetterfühlen." The author has been investigating the aches and pains of the inmates of a home for old soldiers.

However, these questions remain obscure. There is an excellent opportunity here for some original work.

A New Way of Studying Astronomy

The Ingenious Celestial Sphere Invented

By Prof. Wallace W. Atwood



Prof. Wallace W Atwood of the University of Chicago

ON the evening of June 5th, in the museum of the Academy of Sciences in Lincoln Park, Chicago, a large celestial sphere was opened for inspection.

This huge sphere is so constructed that an audience of about fifteen people may enter at one time After the audience has entered, the door is closed and in a few moments as the eyes become accustomed to the darkness the representation of the stars becomes evident. Little by little, more and more of the familiar stars may be seen until the effect is of a beautiful starlight night

The instructor on the evening of June 5th was Wallace W Atwood, the inventor of this apparatus. He used a long black rod tipped with a tiny electric light in the end and pointed out for the convenience of the audience all of the brighter stars and commonly known constellations that were at that time above the horizon

Then, without anyone realizing it, Prof Atwood touched an electric switch and caused the sphere to rotate. Other constellations began to appear at the east; pass overhead and set in the west, following paths precisely similar to those followed by the real stars in the real sky

Soon someone observed that the moon was shining and slowly passing to the westward, and that at the appropriate time and at the appropriate place in the eastern horizon the sun appeared. The sun is represented by a small electric light that so illuminates the interior of the sphere that the stars are no longer seen.

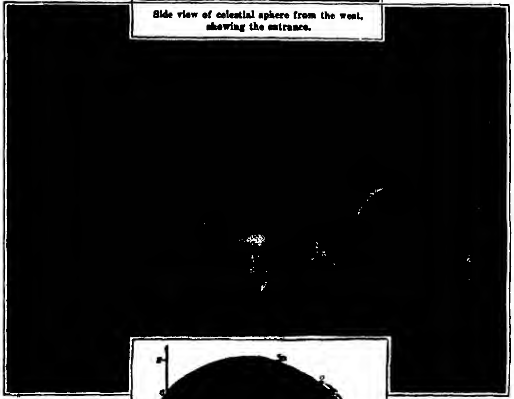
The Chicago Academy of Sciences has appreciated the increasing interest in astronomy, and the difficulty which every one meets in trying to become familiar with even the brighter stars and more commonly known constellations. Various plans for promoting this study were considered by the Academy The flat star charts are confusing to the untrained observer, and the globes, on the outside of which stars are sometimes represented, are unsatisfactory

Through the use of the Atwood celestial sphere, it is possible to become familiar with all the constellations that are visible in the latitude of Chicago. Few people have had the opportunity of seeing all of these constellations, for on a given evening it is possible to see but a few of them and the apparent motion is so slow that it would take hours and hours of careful watching to see all of those visible on a single perfectly clear night.

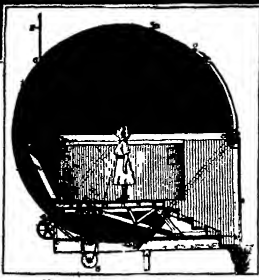
The stars of the first, second, third, fourth and a selected number of those of the fifth magnitude visible from the latitude of Chicago are represented in the sphere, and the total number is 692. In addition to the fixed stars, four planets, Venus, Mars, Jupiter and Saturn, are represented, as well as the sun and the moon. The celestial equator is clearly marked in the interior of the sphere, and the ecliptic, or apparent yearly path of the sun among the stars, is also shown.

Many of the mathematical conceptions necessary for the study of descriptive astronomy, which often discourage the beginner, are made, with this sphere, perfectly simple. There is now no reason why any one, including the youngest school children, cannot become familiar with the chief constellations, their apparent movement, the brighter stars and the real and apparent movements of sun, moon, and planets.

Side view of celestial sphere from the west, showing the entrance.



A flashlight of the instructor pointing out the constellations and stars to small children.



North-south cross section of sphere.

1 2. South Polar ring at entrance 3 Upper wheel supporting sphere. 4. One of two lower wheels which support the sphere and are propelled by motor 5. Electric motor. 6. North Pole of the heavens. 7 8. Horizon table. 9. Observers' platform 10 Switch board. 11. Electric wire. 12-13. Ecliptic or the sun's apparent path.

Many of the fundamental ideas in mathematical geography necessary in elementary education are also easily demonstrated with the sphere

The Atwood sphere now in the Academy building was constructed, installed and presented to the Academy by Mr LaVerne W Noyes, president of the Board of Trustees, in order to broaden and promote the educational and scientific work of the Academy

Construction of the Sphere.

The material used in constructing the sphere is very light galvanized sheet iron, 1/64 of an inch thick, which has been pressed to the proper curvature and soldered to the equatorial ring and to a much smaller ring about the entrance to the sphere The separate sheets lap sufficiently to be soldered upon one another The platform and horizon table are of wood and rest upon a very strong steel frame

The diameter of the sphere is fifteen feet The weight, exclusive of the platform is a little more than 500 pounds. This weight is carried by a 2½ inch tube attached to the outside of the sphere along the line of the equator and resting upon three wheels as shown in the cross section view The two lower wheels carry the greater portion of the weight, but the third and upper wheel above the door resists a certain thrust due to the inclined position of the sphere The stationary platform within the sphere is supported in part by steel trusses resting upon the framework of the museum balcony and in part by two upright pillars which rest upon the great I beam of the main floor of the museum This platform carries a circular horizon table below which the sphere is obscured from view, and above which there is a complete hemisphere on which the stars are represented

The observer in this sphere is located on the surface of the earth at north latitude 41 degrees 50 minutes. Celestial spheres constructed for localities having other latitudes north or south would be placed at other angles and certain other constellations would be represented Thus a celestial sphere constructed for Buenos Aires to represent the southern heavens, would be so placed that the observer would enter from the north polar region and see the southern constellations, not visible at Chicago observe the courses of sun and moon north of him, but fail to see any of the constellations about the North Pole of the heavens as seen from the latitude of Chicago

Attached to the steel structure supporting the sphere is a small electric motor which propels the two lower wheels supporting the sphere and their rotation causes the sphere to rotate

The electric power for rotating the sphere and the light for illuminating the interior are controlled from within the sphere. The electric current necessary for representing the sun is received at the North Pole at a rotary contact, and carried by the insulated wire to the ecliptic, about which there is a wire on the inside of the sphere.

How the Stars, Planets, Sun and Moon are Represented.

The stars are represented by tiny perforations in the sphere Different sized perforations have been made to represent stars of different magnitudes. The size

and location of each star in the sphere have been determined with great care by using an instrument especially designed for this purpose, so that the sphere is an accurate miniature representation of the heavens.

The shifting positions of the planets Jupiter, Saturn, Mars and Venus among the constellations have been provided for by a number of openings made to represent the different positions of each of these planets at different times of the year. The openings not in use are very readily covered.

The sun is represented by a small electric light which may be moved from place to place along the ecliptic and thus be kept in its appropriate place among the stars. The moon will be represented by a series of small disks cut to represent its various phases and coated with a luminous salt. These disks may be moved from point to point along the orbit of the moon and thus represent that body in its appropriate position in the heavens.

Record Journeys by Aeroplane and Airship

THE cable and wireless last week flashed to America the news of two record trips by lighter-than-air and heavier-than-air craft respectively, that illustrate how far behind the old world the new world is in the matter of aerial navigation.

The first noteworthy flight, which preceded the other by one day, was made on June 9th by the latest Zeppelin airship "Sachsen" from Baden-Baden to Vienna - a distance of 435 miles—in 8 hours time or at an average speed of 54 1/3 miles an hour. This huge air-craft, which is fitted with three motors each of 145 horse-power, carried 24 persons on a visit to Emperor Francis Joseph of Austria. Three years ago Count von Zeppelin attempted to visit the Emperor by airship on the occasion of his 80th birthday, but without success. This time, however, he made a perfect flight. Piloting his airship himself, he left Baden-Baden at 3 A. M. and arrived at Vienna at 11—about half the time required by express trains for the journey. Four hundred soldiers assisted at the landing of the huge rigid dirigible on the Aspern Fields. Two hours later a terrific storm swept the parade ground, but fortunately the giant craft was so securely moored that she lived through it without mishap. The next day, in stormy weather, she made her way back to Friedrichshaven safely. The "Sachsen" is the seventeenth Zeppelin airship. She is soon to be stationed at Leipzig while twenty more are being constructed in addition to the ten at present in service.

The greatest achievement and longest flight of a heavier-than-air machine was that of the brilliant young French aviator, Brindejonc des Moulinais, who covered close to 1,000 miles in 14 1/3 hours elapsed time under terrific weather conditions. He used the same monoplane with which he flew from Bremen to London recently. It is fitted with but an 80 horse-power Gnome motor and made remarkable speed for its power, doubtless on account of a favorable wind.

Starting from Villacoublay at 3 55 A. M. M. des Moulinais made a non-stop flight of some 4½ hours' duration. He landed at Wanne, in Westphalia, in the teeth of a 50-mile gale, and after a stop of 35 minutes resumed his flight to Berlin. He arrived at the Johannisthal aerodrome at 12:04 P. M. (11:04 Paris time), having covered the 575 miles from Paris to Berlin in 6 hours and 34 minutes flying time, or at an average speed of 90 miles an hour. When this daring aviator arrived, there was such a stiff gale blowing that none of the local aviators would risk making flights.

After a 3 1/3-hour rest, although the gale did not decrease, M. Brindejonc for the second time resumed his flight, traveling with the wind toward Warsaw. He covered the 150 miles to Posen in 1 hour and 18 minutes, or at the rate of 112 miles an hour. He left Berlin at 3 37 P. M. and arrived at Warsaw—358 miles distant—at 7 15, requiring but 3 hours and 38 minutes for the non-stop flight and averaging 97½ miles an hour. The total distance of 933 miles had been covered in 10 hours and 12 minutes flying time at an average speed of 91.47 miles an hour as against 27 hours required by the Nord express for the journey. Even the elapsed time was practically one half that of the railroad schedule, while the time in flight from Paris to Berlin was little more than one third of the time required by rail, which is 18 hours.

French Prize Competition in Aviation

THE United States Consul at Sidney, Nova Scotia, referring to the competition to be held in France for $100,000 in prizes for the greatest inventions showing progress in safety in aviation, states an entry will be made from Cape Breton by W. A. MacKay of North Sidney, Nova Scotia, whose invention is a parachute folded in a horizontal position on the tail of a flying machine and harnessed to the aviator and kept folded by strap connection to electro-magnetic releases, which on the pressure of a button open, lifting the aviator out of his seat, so the parachute will become, as expressed by the inventor, the life buoy of the aviator. It is stated that a preliminary test of the invention will shortly be made at the laboratory of Prof. Graham Bell at Baddeck, Nova Scotia.

The True Sandalwood of India

IN the most ancient times the demand for the well-known sandalwood was very great as an incense for the idols. Its use dates back for more than 2,000 years, and all the records bespeak its rarity and costliness, in fact it always was prized more highly than any other wood. But with the advance of civilization new uses and applications opened up by scientific research, at once increased its consumption many fold. This is chiefly for carving and for manufacture of perfumery and medicine. It is obvious that wood with such a wide range of uses is in danger of being exhausted. As in the old days, so now, it is rare and on account of its scarcity very costly. And, unfortunately, sandalwood is rapidly becoming scarcer and more expensive, and the question is asked, How is the production and supply to be maintained proportionate to the demand? The importance of the question is shown by the efforts that are being made in India to cultivate this tree. It is consumed to some extent in India for incense and for wood carving, but a large part of the production is imported into China, where it is highly esteemed as an incense, the Chinese readily paying from two to four times more for the Indian sandalwood than for the less valuable substitutes from the South Sea Islands. The Indian species fully deserves to be designated the sandal tree proper, and the bulk of the sandal oil of commerce is produced from it.

The sandal tree (*Santalum album*) is an evergreen, a member of the sandal tree family. The best known related plant in the United States is the bastard toad flax (*Comandra umbellata*). The term "sandal" or "sander's" wood as was the old English name of it, is probably derived from an East Indian name *chandana* or *sandana*, which is used very generally to indicate various kinds of so-called sandalwoods, and it is quite probable that the name is applied also to other aromatic woods.

The sandal tree is one of the small objects in the forests of India. Even in locations of its best development it attains dimensions that rarely exceeds 40 feet in height and varies from 8 to 12 inches in diameter, or sometimes as much as 15 inches. It is said to have been known to reach 22 inches in diameter at the base, but this can be the case only with very old trees growing in very favored locations. As a rule they are only from 20 to 30 feet in height and from 6 to 8 inches in diameter when they are cut down.

The tree is a native of the mountainous districts of Southern India and is confined mainly to the dry regions. Its finest growth and development is reached in Mysore and Coorg, where the most oily and heavily scented wood is found between 2,000 and 3,000 feet elevation. While it is restricted to comparatively narrow limits the sandal tree has become naturalized in several countries, notably in certain districts in South Africa, where attempts have been made to plant it on a commercial scale.

It will endure a wide range of climatic and soil conditions, especially in protected places, but it will not respond to treatment like the majority of trees desirable for planting for revenue. The tree thrives best in a red or black loam or in fine gravelly soil with free drainage, especially where the soil is rocky. For the production of a large proportion of heartwood which yields the oil, the sandalwood tree must be grown under the most favorable conditions. The trees are seldom found in heavy timber forests, but occur chiefly in light deciduous forests. Flat ground and gentle slopes are preferred and the greatest bulk and height are attained with a moderate heavy rainfall. Rich soil is required for rapid growth, but this does not necessarily add to the oil content of the wood. For most of the uses other than the commercial distillation of the oil, the tree may well be cultivated wherever it can be made to live.

The importance of its cultivation may be urged, inasmuch as every part is of use, from the roots to the young branches that have any heartwood developed. The chief commercial uses of sandalwood is for the extraction of sandal oil. The older, larger roots yield the greatest proportion of sandal oil. In India and Ceylon it is customary to dig up the trees by their roots and distill the oil from stump and root wood as well. The best oil comes almost exclusively from the root wood. The proportion of the valuable scented heartwood is only about one half of the log, while the sapwood has little or no value. Even the fragrant sawdust or powder is used for distilling the sandal oil and sells at the wood depots for from $130 to $165 per ton. Not all the sandalwood is employed for oil, but with its yellowish-brown color and susceptibility to a fine satin-like polish the wood is particularly adapted for making all sorts of ornamental wood, wood carving, engraving, and for cabinets, chests, and drawers proof against insects. The chief reputation for sandalwood in Europe rests upon its use for carving. It is also employed for making jewel and work boxes, cabinets, writing desks, walking sticks, picture frames, fan handles, pen holders, card cases, trays, and when powdered is used to scent clothes. Large quantities of the wood are shipped to China for making coffins for the rich.

The exploitation of a number of other closely related or even entirely unallied species in the South Sea Island, and in parts of Africa was undertaken, but it has now practically ceased. It is said that several species of *Osyris* in East Africa will gradually supply the demand, but the wood is not only inferior to true sandalwood, but the production in any considerable quantities is doubtful. The export of the substitute sandalwoods from Australia is generally decreasing, while the supply from the Hawaiian Islands is entirely exhausted. That the production has ceased at the established sources of supply is not to be wondered at. Sandalwood cutting has been carried on in the most recklessly extravagant manner possible. In Hawaii and Australia the substitute sandalwood trees have all been cut out, and in many parts of Australia the stumps of the trees felled fifteen to twenty years ago, are now being dug up and shipped to the large markets in China.

In India attempts have been made for a number of years to keep up the supply by artificially restocking the forest, but the rate of planting has thus far been totally inadequate. Laws have been enacted to prevent the wanton destruction of the trees. Other causes besides extravagant cutting contributed to the decrease of sandalwood in India. Frequent fires and unrestricted grazing destroyed enormous quantities of young trees, and after careful investigation it was determined that a government monopoly in Mysore in Southern India was the only means of saving the most costly of all the Indian woods. This caused the quotations at home and abroad to rise. A good deal of the wood now brought to the market is cut in hedgerows and scrub jungles outside the areas marked as reserved forests. Since the monopoly is in force the sandalwood trade is more or less uniform from year to year, and the systematic exploitation of mature trees in the forest reserves will tend to keep the regular supply of the wood in the world's market.

Ammonia as a Disinfectant

RECENT experiments by Dr. Riegler of the Institute of Hygiene of Buda-Pesth have the highly important result of proving that ordinary ammonia is a powerful disinfectant, even in the case of the most virulent diseases. As reported in the *Centralblatt für Bakteriologie*, the method of use was most simple, consisting merely in placing the ammonia in shallow vessels in the room, which was then, of course, hermetically sealed.

For a room containing 100 cubic millimeters of space 1 kilogramme of ordinary ammonia was used, with these results:

After 1 hour	there had evaporated	200	gr. of liquid
" 2 "	" " "	250	" " "
" 3 "	" " "	300	" " "
" 4 "	" " "	350	" " "
" 5 "	" " "	390	" " "
" 8 "	" " "	450	" " "

Examination of tissues previously impregnated with microbes showed that the bacilli of cholera and typhoid were killed at the end of 2 hours, the bacteria and spores of anthrax in less than 3 hours, and diphtheria in 8 hours. The method is not only effectual, but cheap, simple, and non-harmful to walls, pictures, carpets, and furnishings.

The Current Supplement

THE front page illustration of our current SUPPLEMENT shows a roller gaging machine specially designed for the rapid and accurate measurement and assorting of bearing rollers.—F. V. Colville writes on "The Formation of Leaf Mold," a most important process in humus formation.—Prof. E. G. Coker, in an illustrated article, describes the application of optical methods to the determination of stresses in mechanical structures.—The history of the development of moving picture photography presents several points of interest, which, together with other points, are brought out in an article on "Kinematography Carried to Extremes."—A note, "How to Tell Artificial Silks," should be of interest to many readers.—F. W. Henkel writes on "Double and Binary Stars."—An article of particular value entitled "Sea and Air Command" discusses the Anglo-German war policy; England is re-enforcing its fleet; and Germany retaliates by building up a powerful air fleet.—A. H. Kennedy draws attention to the peculiar tendency of numerous natural processes to display a twist in a direction "Against the Sun."—A. G. Hebern writes on a new law of valenzination.—P. H. Lüke discusses the probability of the existence of an ultra-Neptunian planet, and the methods at our disposal for investigating the problem.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Winchester Cathedral

To the Editor of the SCIENTIFIC AMERICAN

As a regular subscriber to the SCIENTIFIC AMERICAN and as one who has visited Winchester cathedral and taken much interest in its architectural history, I hope I may be permitted to offer a correction of the article in your issue of May 10th

Under the title, "Saving a Cathedral With a Diver," you state that Winchester cathedral was built by William of Wykeham in 1079. According to the Encyclopedia Britannica, the cathedral was built by Bishop Walkelin (1070-1098) and remodeled by Wykeham in 1394 This agrees with the accounts in several books on English architecture in which is described the transformation under Wykeham in 1394 of the nave from the Norman to the perpendicular style.

New York. LEONARD OPDYCKE

The History of the Arch

To the Editor of the SCIENTIFIC AMERICAN

A correspondent in your issue of May 24th calls attention to the history of the arch, and expresses surprise that the true arch was not employed in the pre-Hellenic Ægean The following facts, current among archæologists, may have bearing upon this question

In Babylonia, clay was the common building material from the earliest times, as stone was not easily obtainable Clay also *preceded* stone in Egypt (cf Petrie's excavation in Abydos, 1902) In the Ægean, on the other hand, stone and wood were used, brick constructions are almost unknown (Troy II and III, where stone was hard to procure, and Asiatic influences predominated, do not furnish valid exceptions)

Beyond question the corbeled arch was the earliest type known, and a form familiar to the most widely separated peoples. Such highly finished cupola-forms as the famous "Treasury of Atreus" reach the acme of development in this direction Here, naturally, Ægean architects stopped Their stone arches were strong and handsome, what necessity was there for change?

In Babylonia (and Egypt) however, where unburned brick was used, such a structure could not have been lasting, since without adequate support the two opposite walls would soon fall in. While repairing this damage, what could be more natural for the mason than to stumble upon the idea of laying the bricks in directions converging toward the center? In this way the walls would be held apart, and a little buttressing would prevent the bulging Indeed, the very ruins of our arch might reasonably suggest the improvement. With the burned-brick arch its evolution was complete, so far as Babylonia is concerned

A few remarks regarding chronology may be *à propos* here. The correspondent quotes the chronology of Petrie and Breasted in the same breath, and they differ in the period under question by a thousand years! This leads him to an unfortunate inaccuracy in stating the relative ages of certain Egyptian arches. The dates given by Breasted are based on Eduard Meyer's researches, and are, in their broad outlines, accepted by nearly all Egyptologists. The Babylonian dates are no less than 1,500 years too high, as conclusively proved by Father Scheil's discoveries (1911-1912) Accordingly, 3000 B C. should be read instead of 4500 B C

Menno, So Dak. W. F ALBRIGHT

Suggestions on Reservoir Control of the Missouri

To the Editor of the SCIENTIFIC AMERICAN

The writer studied with much interest your very forceful and unique illustration of the intricate and wonderful problem of the Missouri-Mississippi overflow conditions The article of your chief editor is full of thought and facts

It occurs to the writer that one must live in this great basin to realize the full significance of the problem before us. It is certain that the dike or levee system is inadequate, and it is doubtful if any system will ever be devised that will entirely cure the distress, for nature is limitless, though it is the opinion of the writer that a system of head-water control, added to that of levees, can and will cure any overflow equal to that of the past.

The cost of head-water control has many features of which we can take advantage. The western watershed of the twain rivers is much different from the eastern watershed; it is not nearly so abrupt, and flows across a broad plain from three to five hundred miles wide In this plain are many natural basins, varying from a square mile to possibly fifty square miles. The comparatively level country will admit of dams costing from one hundred to the thousands, which will be sufficient to turn the [illegible] of streams now running into the Missouri, not only stopping what the dams will hold, but a continuous stream.

Again the writer differs with the editor, in that the amount of discharge necessary to control the greatest floods is given as 2,300,000 cubic feet per second, which at once gives a problem beyond even the thought of the finite mind, but when you take into consideration that the normal discharge is 610,000 cubic feet per second, and that the natural banks will permit, without levees or overflow, three times this amount, or 1,830,000 cubic feet per second, then man has only to master 470,000 cubic feet per second, and to do that he has both the levee and reservoir helps before him. It has already been demonstrated that the levees will care for practically two thirds of this flow In my mind it is quite feasible to care for the other third by head-water control.

With comparatively small cost, 300,000 square miles of the western watershed of these great rivers could be entirely cut off This could be accomplished by the forming of a chain of artificial lakes stretching through North and South Dakota, Nebraska, Kansas, and Oklahoma. These lakes, formed by damming the tributaries crossing this country, could be connected by an artificial river, and the water in flood times turned into the natural basins or down this artificial river, and most of which would be used to irrigate those great plains

Ness City, Kan J C HOPPER.

The Mississippi Problem

To the Editor of the SCIENTIFIC AMERICAN

For years I have been watching the floods which yearly devastate large sections of the Mississippi valley I have also taken an interest in the plans put forth to lessen this evil, and have been greatly pleased with the stand your publication has taken in regard to this question of controlling the floods

The question is of such vast importance, and affects such a vast area, that only by the most careful and painstaking study can a rational solution of the matter ever be reached

Many writers seem to think that it is a subject that can be handled easily if the national Government will only accept their theory and begin work

These floods are not of recent origin, but date back long before the advent of the white man in America. True, under the old conditions the waters did not reach the rivers as fast as at present, and the damage was confined to smaller areas than now

All over the Mississippi valley were formerly scattered small sloughs, swamps, and lakes which served to hold back the flood waters, but the white man has changed all this The bottom of these low places contained the richest soil in the country, and man is to-day looking for rich soil, and when a ditch, long or short, big or little, will uncover thousands of acres of land, he is going to dig that ditch, and the result is that in Iowa alone over four hundred millions are being spent in tiling and ditching, and the water which was formerly weeks in reaching the river now gets there in a few days, and what is more, untold thousands of gallons which formerly was held back until it evaporated, is now rushed to the big rivers at once To-day there are not ponds and lakes enough in Iowa to hold back the water which falls in an hour

This talk of building reservoirs, it seems to me, is the most ill-timed and weak of any proposition that could be advanced. To build reservoirs you must have deep valleys and high hills. In a large part of this country we have no place where a reservoir could be constructed All the lakes and depressions in Iowa and Minnesota together would not hold the water of the Mississippi for one day when at flood What is more, it takes more land to hold water impounded than when running off, and it would take five times the land to hold back the water that is flooded when the water is running away as fast as possible

Those who advocate diverting the waters by digging canals have not seriously considered the size of the canal which would be necessary to give any appreciable help to such a river as ours when at flood

If all the machinery of the Panama Canal was to be brought here and set at work, it could not in one hundred years cut a channel large enough to relieve the conditions which have come up during the past two years Much can, no doubt, be done to clear our rivers from obstruction, but it is so much easier and cheaper to build an embankment three feet high than it is to excavate three feet from the river bed, that the two propositions need only to be compared to convince the most stubborn

It is possible we have started to build our levees too close to the river, not allowing room for the water to spread out over enough ground If so, we must back up and begin over. If we build levees the material is always at hand, and all the dirt put into the levees can be taken from the river side and thus help to enlarge the stream

The history of drainage is the history of pouring the water from the upper land onto the lower It has been going on since the country was first settled, and it will never be reversed. The upper land should and must help pay the expense of protecting the lower land, but they will never be able to send it up hill or hold the water back on the higher land.

Such floods as recently devastated Ohio and adjoining states cannot be entirely prevented. They will come like great fires and tornadoes, but much can be done to lessen the loss and relieve the suffering

Where possible the Government should construct reservoirs, not so much to prevent floods as to hold back the water for power. Where practical, rivers should be straightened, but for protection we must depend upon dikes, and we must therefore make them high enough and strong enough to do their work

Manson, Iowa. T D LONG

The Moffat Tunnel

To the Editor of the SCIENTIFIC AMERICAN

On page 509 of the SCIENTIFIC AMERICAN, published on June 7th last, there appears an interesting story, entitled "The Moffat Tunnel Through the Continental Divide" I quote part of it, as follows

"It will reduce the route from Denver to Salt Lake City to 68 miles, as against 187 miles by the Denver & Rio Grande route, which is at present the shortest."

Our Book Club is a regular subscriber to your magazine and I read it with great interest, but in order that those who do not know that Western country may not gain a wrong impression from the above statement, I would respectfully suggest that it be revised and notice made of it in some future issue

Having lived in Colorado for about four years, I presume that what the writer meant to say was that by driving this tunnel through the Continental Divide, the new route from Denver to Salt Lake would be materially shortened by going under the mountains rather than by climbing over them The actual distance from Denver to Salt Lake by the Denver & Rio Grande is 741 1 miles, so that from this you can readily see the inaccuracy of the above statement I make this suggestion in all friendliness and wish you continued success

Boston, Mass CHARLES A BARRY

[The note should have read "It will reduce the present shortest route from Denver to Salt Lake City by 68 miles, and the Denver & Rio Grande route by 187 miles"—EDITOR]

Pennsylvania Forestry Exhibition

To the Editor of the SCIENTIFIC AMERICAN

During the week of May 19th to 24th, a most interesting exhibition was held under the auspices of the Pennsylvania Forestry Association at the Horticultural Hall in Philadelphia. The exhibition was free to the public, except on Monday, when a reception was held by the Association In the afternoons and evenings illustrated lectures were delivered by men prominent in matters of forestry throughout the country Among the exhibitors were included the Pennsylvania Department of Forestry, the Pennsylvania Chestnut Tree Blight Commission, Pennsylvania State College, Pennsylvania State Museum, Harrisburg Pa, American Forestry Association, Washington, D C, the United States Forest Service, Washington, the United States Reclamation Service, Washington, besides many other institutions, societies, and business corporations.

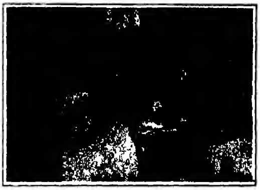
The exhibition was primarily planned to arouse public interest in the conservation and re-establishment of the forest wealth of the State Through the lectures it was of remarkable educational value, and judging from the attendance, was far reaching in its effect. The fact that certain important bills for the protection of forests in Pennsylvania were at the time pending before the State Legislature, added to the value of the exhibition

The lectures covered a wide range of subjects related to forestry and the conservation of our lumber supply Among them may be mentioned "The National Forests," by Prof Henry S Graves, U S Forester, "Forestry and the Lumber Industry," by S B Elliott, Pennsylvania Forestry Reservation Commission "Diseases of Our Forest Trees with Special Reference to the Chestnut Blight," by Irwin C Williams, Deputy Commissioner of Forestry and "What Forestry Can Accomplish," by Prof J A Ferguson, Dean of the Department of Forestry, Pennsylvania State College

If similar exhibitions could be held in all our lumber-bearing States, they would undoubtedly lead to the stimulation of public interest in the great economic question of saving what is left of our forests, and to the encouragement of legislation tending to help the replanting of devastated areas. E J D COXE

Philadelphia, Pa.

A Kocher Anniversary—The University of Berne recently celebrated the 40th anniversary of Prof Th Kocher's teaching at that institution, this eminent surgeon having received the Nobel prize in 1909 On the present occasion Prof Kocher made a donation of \$40,000 to the university, which with the interests, is to form the basis of a fund of \$100,000, this to be used for founding a biological institute in connection with the university



Scott (on left) and companions in their fur sleeping bags.

Taking sample of sea water and temperature readings.

Cooking in the tent is surmounted under numerous difficulties.

To the South Pole With the Cinematograph

Film Records of Scott's Ill-fated Expedition

[*LITTLE need be said in introducing to our readers the photographs reproduced with this article on Mr. Ponting's remarkable work as a member of the ill fated Antarctic Expedition in which Capt. Scott and four of his fellow explorers lost their lives. The excellent views here shown, which, aside from their artistic and popular interest, are of no inconsiderable scientific value, are part of the Gaumont moving picture film record now being exhibited in several of our large cities.*—EDITOR.]

In all the centuries of polar exploration north and south the records have fallen markedly short of perfection in one essential element, owing to difficulties that until recently seemed never to be overcome. It is in the matter of illustration that the failure has been most apparent. Scientific observations have been complete, graphic accounts of adventure and valuable reports of conditions have appeared in the writings of explorers from the very first. But artists with pencil and brush have failed to carry conviction and realization to the mind of the people who stayed at home, and photography even has fallen far short of perfection. The flat pictures of snow expanses and posed portraits of fur-clad explorers with dog sledges brought home by some of the most distinguished of explorers have been hardly more than commonplace, even though taken under the most trying of conditions. In real value, pictorial or scientific, they have served but little better than the quaint engravings of conventional icebergs and auroras of a hundred years ago.

It is in breaking this unvarying record that the British Antarctic expedition, under the command of Capt. Scott, achieved not the least of its noteworthy successes. That expedition from the beginning kept scientific objects ever in mind, and Capt. Scott organized a staff of specialists in every branch of natural science that could properly be expected to find material in the Antarctic. Furthermore, it was recognized that photography might well play a more important part than ever before, and for this reason there was attached to Capt. Scott's staff one of the most distinguished photographers and cinematograph operators in the world, Herbert G. Ponting, Fellow of the Royal Geographical Society, himself an explorer in many lands. Mr. Ponting approached his unique commission with a serious mind. He assembled equipment of photographic apparatus of a variety and perfection to meet every trying condition that could fairly be expected to develop in the Antarctic. He anticipated and organized for the difficulties to be met, and sailed southward toward the unknown with what was practically a new commission from science.

The result has proved the wisdom of the original plan and the excellence of Mr. Ponting's preparations. Literally thousands of negatives were made from the fall of 1910, when the expedition sailed south from New Zealand until the time when it ultimately emerged with

Throwing the gang plank from the "Terra Nova" on "land," in this case thick ice

A seal preparing to slip from an ice block into the sea.

Unloading the "Terra Nova." Carrying provisions to winter quarters on sledges.

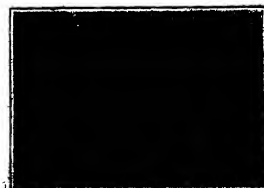
A Weddell seal mother and her young. The skin of this seal has no commercial value.

The tent in which the explorers died. It stood up well in terrible blizzards.

Penguin hatching egg on a nest of stones. Both male and female birds sit on the eggs.

Preparing to unpack the tent after a hard and a long pull.

One of the Siberian ponies in active antarctic transport service.



Hatching under a variety of [illegible]

What the net brought up from the sea: sponges, starfishes, etc.

A square-shaped sail spread to assist in drawing a snow-sledge.

Dr Wilson with one of the fourteen Siberian ponies.

Two of the team of Siberian dogs that were always reliable.

the news of the disaster to the polar party last February Besides the individual photographic negatives Mr Ponting brought back with him over 25,000 feet of films, and important selections from these are now being shown by cinematograph in several American and European cities.

In spite of the difficulties that beset Mr Ponting in this undertaking, the results, photographically speaking are worthy of being ranked with the best that have ever been shown with the cinematograph

The difficulties began almost from the moment of starting. In order to photograph the actual progress of the bow of the "Terra Nova" in forcing its way through the ice pack in the Antarctic Ocean, a staging built from two planks lashed to the deck and the rail was extended far out over the side of the ship, and partly resting on this and partly suspended by rope from above Mr Ponting sprawled on his face and turned the crank of the cinematograph, while some of his most successful exposures were made

Preliminary to arranging for the display of these pictures, Mr Ponting made a recent visit to the United States, and had many interesting things to tell of the conditions under which he had worked

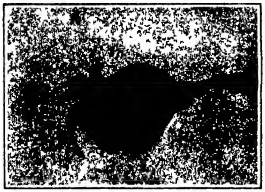
"Difficulties?" said he, in telling his adventures shortly after reaching this country of course there were many of them. Compared with polar photography, everything is easy It is not only the difficulty of the light. That is soon mastered. The temperature is where the real trouble comes from If you take off your glove and put your naked hand near the lens, instantly the lens is covered with a film of ice that no mere rubbing will remove

Sometimes moisture, condensing into the finest particles of ice, will get inside the lens—then you are through. A grave danger anent the camera is the brass knobs. If by accident, you touch with your bare hand any part of the brass of the apparatus, it will burn you just like a red-hot iron On one occasion I was focusing under my cloth when I happened to moisten my lips. The point of my tongue came in contact with the metal and instantly froze there, the shock was so great that I went over backward, and when I recovered I found that I had lost the tip of my tongue, which remained frozen to the camera

"I recall one instance when I thought every moment was my last on this earth (or rather on Antarctic sea-ice) None of us were familiar with the ferocious killer whales, and so when we sighted a large school of them after seals, I disembarked and hastened over the ice to film the thrilling scene Imagine my amazement when they gave up their chase after the seals and attacked me Over a dozen of them formed into line, and diving under the ice, heaved their backs against the ice, breaking it up for hundreds of yards, and it was all that I could do, with the assistance of my comrades, to regain the safety of firm ice again with a school of vicious whales exerting their every effort to get me into the frigid waters.

(Concluded on page 568.)

View of the end of a sledge with a cyclometer attached.



Seal in the act of scooping steps in the ice with his teeth.

Mr Ponting among the penguins, and at a very close range.

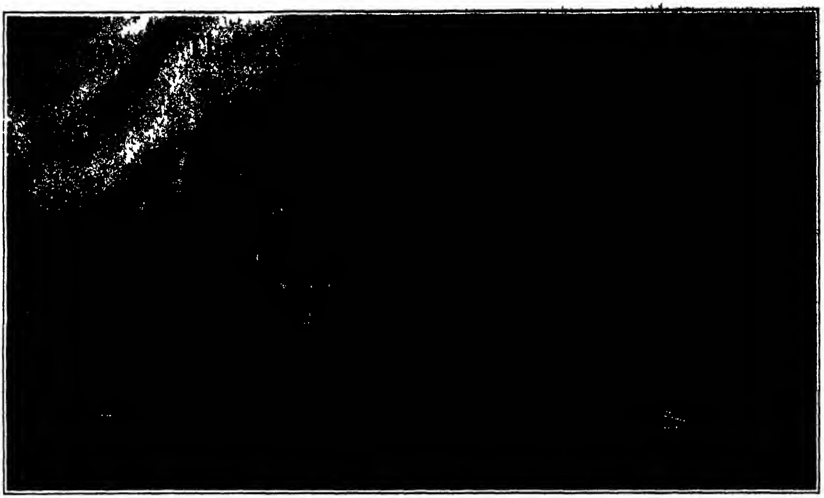
Skua-gull with its chick, which it will furiously defend.

One of the motor sledges hauling a number of trailers with supplies.

[illegible] their nests, which are formed [illegible]

A flock of penguins. These birds are unable to fly with their clumsy wings.

Climbing an overhanging glacier of peculiar form. A perilous feat



THE Imperator which is the newest of the liners built to ply the waters between the United States and Europe is also the greatest She is almost one fifth of a mile long—to be exact, 919 feet Her beam is 98 feet which compares favorably with that of a pretentious city street and her tonnage is 50 000

No less remarkable is her machinery The Imperator is driven by quadruple turbine engines developing 62,000 horse-power which drive the ship at an average speed of 22½ knots The reversing turbines develop about 35 000 horse-power There are four propellers measuring more than 16 4 feet in diameter and revolving at a normal speed of 185 revolutions a minute

Since mere figures tell but little perhaps the real size of the Imperator may be best judged by her accessories For example no less than five great anchors are carried of which the main anchor the largest in the world weighs 26 455 pounds The combined weight of the five anchors and their chains is 485 082 pounds The cargo of many a small steamer is not much larger

Some idea of the size of the Imperator may also be gained from the fact that her sides are built upon 827 steel ribs, on either side each weighing a ton and a third The weight of the steel plates angles profiles and the like totals 360 tons. More than 2 000 000 steel rivets were used each weighing eleven pounds No wonder that the tonnage of the Imperator is fifty thousand

Because of her great size her decks are particularly imposing Two of her three broad decks are partially inclosed The promenades vary in width from 16 to 23 feet, while the circuit of the deck is equal to a walk of about five ordinary city streets None of the ventilating funnels common to many steamers are to be found on the Imperator Hence her entire upper or sun deck can be used for games and for promenading

That the Imperator is in truth huge is driven home by the quantity of provisions carried For a seven day voyage between New York and Hamburg the Imperator takes on board 25 tons of fresh meat, 48 000 eggs and 60 tons of potatoes The larder besides contains 14 tons of fresh vegetables and 6,000 tins of canned vegetables. Besides there are over five tons of fowl and game and 4½ tons of fish and shell fish 800 pounds of mushrooms and 4,000 cans of preserved fruits. No less than 1,500 quarts of milk and cream 400 pounds of cheese 500 pounds of chocolate and cocoa and 7 000 pounds of coffee are also taken on board

A more comfortable or more luxuriously equipped craft than the Imperator it would be difficult to imagine The passengers have a great choice of dining rooms ballrooms winter gardens, palm rooms grill rooms smoking rooms gymnasiums, roof gardens, and lounges There is a practical stage for theatrical performances a running track an elaborate Roman bath and swimming pool a florist's shop, a candy shop a photographic dark room electric elevators and other features not found on most transatlantic steamers.

The furnishings of the Imperator too are remarkable The leading decorators of Europe have been given *carte blanche* Thus the main lounge, which may be converted into a ballroom is hung with Gobelin tapestries. The sumptuous Roman bath reproduces with great fidelity the famous Pompeian Hall in the Louvre. The pool which is surrounded by decorative Pompeian pillars measures twenty-one by thirty nine feet.

The provisions for safeguarding passengers on this largest of ships will naturally arouse interest As we have already pointed out in these columns, the "Imperator" is built with an inner skin and with both longitudinal and transverse bulkheads All told there are no less than sixteen steel bulkheads forming in all thirty six watertight compartments. Further subdivision is secured by steel decks The bulkheads have been carried to the level of the second deck high above the water line That they will perform the function for which they are designed has been proven by actual test for the compartments have been completely flooded to ascertain their efficiency under extreme conditions. The compartments are hydraulically closed from the commander's bridge Auxiliary controls are to be found on the upper deck

Eighty three large lifeboats are provided—sufficient to accommodate 2 496 passengers and a crew of 1 180 Two of these are motorboats, high powered enough to tow the others and equipped with wireless telegraphy

The main staircase of the "Imperator."

The smoking-room has a large tastefully designed fireplace.

apparatus having a range of over two hundred miles. Besides the usual life-belts, illuminated life-buoys are provided.

The wireless equipment of the "Imperator" has a range of 1,800 nautical miles There are two reserve antennae and two receiving instruments for long and short waves, designed for news service and rescue work. The station is manned by three expert operators one of whom is constantly on duty So powerful is the wireless equipment that the vessel will always be within ethereal hailing distance of land.

An International Commission on Agricultural Meteorology

THE International Meteorological Committee recently appointed a commission on agricultural meteorology comprising the following members M. A. Angot, director of the meteorological service of France Dr Richard Börnstein, professor at the agricultural high school at Wilmersdorf near Berlin and organizer of the public weather service of Prussia Prof. P Brounov director of the meteorological bureau attached to the Russian Ministry of Agriculture M Louis Dop vice-president of the International Institute of Agriculture and Prof. L Palazzo, director of the meteorological service of Italy

From an agricultural point of view the most interesting person in this group is Prof Brounov as the bureau which he has directed since its organization in 1897 is the most elaborate agricultural-meteorological institution in this world. It comprises about one hundred and fifty special stations scattered over the Russian Empire, at which meteorological observations are made side by side with observations on the growth of plants. To each station is attached a tract of land planted in cereal crops, orchards, etc. An effort is made to keep the agricultural conditions of these plots unchanged from year to year in order that the exact effect of the varying weather conditions may be ascertained. The most important practical object in view is to gage accurately the agricultural climate of every part of the empire in order to guide cultivators in the choice of crops and varieties and in timing their operations The bureau has issued a large number of publications of general interest but nearly all unfortunately in the Russian language

M Dop is prominently identified with the agitation now in progress in Europe in behalf of improving the organization of meteorological work as applied to agriculture He recently prepared an elaborate report on the present status of such work throughout the world which was published by the International Institute of Agriculture

The new commission held sessions last September and drew up recommendations Some of the things recommended are Improved methods of measuring the duration of sunshine and the intensity of radiation from sun and sky more detailed study of fog dew and hoar frost better methods of measuring the temperature of the air at various levels among and above growing plants, the study of optical phenomena useful in making local weather predictions changes in the methods of publishing meteorological observations in order to serve the practical needs of agriculture publication of daily weather maps at several distributing centers throughout each country (i. e. the plan now followed in the United States and latterly in Germany but not elsewhere) an evening weather service where this does not already exist and the rapid dissemination of weather forecasts and warnings in the rural districts (after the example set by the United States Weather Bureau)

There is a feeling among agriculturists throughout the world that they are not getting the full benefit of the elaborate organizations for weather observation and prediction that now exist in all civilized countries. In this respect, however the American farmer is much better provided for than is his brother of the Old World. We already have an adequate meteorological service and the development of agricultural meteorology rests rather with the agriculturist than with the meteorologist.

Preservation of Wood

EPINOY utilizes the property of the alkaline bichromates to render gums and gelatines insoluble when exposed to the light. For this purpose the wood is immersed until complete saturation in a solution containing 2 per cent bichromate of potash and 1 per cent fluoride of sodium After drying the wood is proof against rotting The wood is then painted with a solution containing 2 per cent bichromate of potash 0.4 per cent fluoride of sodium and 5 per cent of gelatine, and is exposed to the light after drying the wood will be covered with a very strong brilliant varnish, and assume a brown color like aged wood.

The "Imperator" carries eighty three large lifeboats, two of which are motor boats equipped with wireless having a range of two hundred miles. Note the manner in which the lifeboats are carried.

Staircase leading to the Pompeian pool, a sumptuous Roman bath reproduced from the Pompeian Hall in the Louvre.

The swimming pool is sixty five feet long and forty-one feet in width.

Concert stage in the grand salon of the "Imperator"

Government Armor Plant.—A bill has recently been introduced in Congress by Senator Ashurst of Arizona appropriating $1 600 000 for the construction of a Government plant for the manufacture of armor plates The author of the bill believes that if Government-built armor were used in the battleship Pennsylvania it would save $1 600 000 Secretary Daniels estimates that an armor plant would cost approximately $11 000 000 but Mr Ashurst has called for a lower appropriation based on estimates made by a Senate committee in 1896

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

The Loud-speaking Telephone

IN the development of loud speaking equipment for announcing purposes, two problems are presented—one that of obtaining sufficient volume and the other that of obtaining clear articulation. From time to time during the past few years, a number of so-called loud-speaking telephones have been developed and placed upon the market. These have either been loud and lacking in clear articulation, or clear in their articulation and lacking in volume, thus failing to strike the desirable medium of clear articulation and sufficient volume.

The question of volume itself necessitates two lines of study, one to obtain that design of apparatus which will permit the largest current being used without injuring the apparatus, and the other that of obtaining the greatest efficiency from the available energy.

In the transmitter, the amount of current which can be used is limited by the mechanical dimensions of the instrument and the means which may be available for keeping the instrument properly cooled. If, however, the mechanical dimensions are too great, particularly those of the moving parts, the articulation is seriously affected. Accordingly, the amount of current which can be used is also limited.

The quality and articulation are largely dependent upon the mechanical dimensions of the diaphragm and the manner in which it is mounted. In any diaphragm a certain tone will be found which is fundamental to it, and as the weight of the moving part which is attached to the diaphragm is increased, this tone becomes emphasized. If the moving mass is not kept exceedingly small, this tone interferes with the proper reproduction of the words transmitted.

The problem of designing an efficient transmitter for this service has, therefore, been that of making use of the largest possible mechanical proportions in order to permit of large currents, without making the moving parts too great in mass to destroy distinctiveness of articulation.

The one particular point followed in the design of the loud speaking apparatus has been the obtaining of a method of construction which will give greater emphasis to the harmonics of the voice and less to the fundamental note. In general, this method will give far better results as far as intelligibility is concerned. This principle has been followed out consistently in the construction of both the transmitter and receiver used in the loud speaking combination.

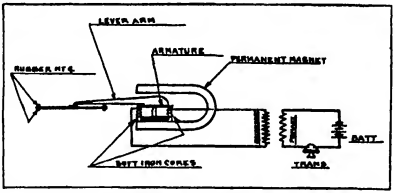
As in the case of the transmitter, the articulation of the receiver is governed largely by the mechanical characteristics of the diaphragm and the method in which it is mounted. In the receiver, the diaphragm has been corrugated and mounted on rubber cushions along the lines of phonograph construction. It was, however, found advisable to depart from one of the usual features of receiver construction and use a metal other than iron in the construction of the diaphragm. This was made possible by the use of an iron armature which would be acted upon by the pole pieces. Phosphor bronze was found to produce the best result from the standpoint of both volume and articulation and has, therefore, been used for the diaphragm. A lever arm connects the diaphragm to the armature.

By employing the magnetic principles used in the construction of polarized ringers, the efficiency of articulation was found to be still further increased. This fact may be accounted for by the resultant reduction in the inertia of the moving parts. The use of a differential magnetic circuit in the receiver has also made it possible to obtain a two-way positive action of the diaphragm. In the normal condition of the receiver the diaphragm is practically free from all tension. This has the effect of greatly increasing the efficiency of construction, due to the fact that a much smaller air gap may be used.

These new and entirely original constructive features have produced a loud-speaking telephone which combines clear articulation with a maximum of sound volume.

The first public appearance of the loud speaking telephones was at the Boston Electrical Show, held in Mechanics Hall, during September and October, 1912. Ninety of these telephones were installed in various parts of the hall and divided, for convenience, into groups of ten, making nine separate circuits, which were originated in a sound-proof glass-inclosed booth in the basement of the Grand Hall. In this booth the special transmitters were located, as well as an ordinary telephone set connected to the lines of the New England Telephone and Telegraph Company. The installation of the telephones was made to demonstrate their use as announcers—to announce interesting events about to take place, to page visitors to the show, and to furnish music from a phonograph in the transmitting booth. Another use to which they were put was to announce the inning-by-inning scores of the World's Series baseball games then taking place. That the telephone produced practical results was evidenced by the fact that a child which had been separated from its parents in the throng was found through its agency; and it was no unusual thing for exhibition officials to be summoned to their offices or to meetings by means of these instruments.

Announcing the score at a baseball game by means of loud-speaking telephones.



Diagrammatic view of the loud-speaking telephone, showing the lever connection to the receiver diaphragm.

Blasting With Liquid Air

By Our Berlin Correspondent

THE first attempts to use liquid air as an explosive were made at an early stage of the liquid air industry. In fact, shortly after the invention of his process, Prof. von Linde (in 1897), by mixing liquid air with charcoal, succeeded in producing an explosive which he termed "oxyliquite." This pulpy explosive was introduced directly into the blast hole and ignited by means of cartridges and fuses. As, however, this primitive process failed to give any satisfactory results, the explosive mass was filled into carefully prepared paper cylinders (preferably immersed entirely into liquid air), which were then introduced into the blast hole. Though sufficient explosive effects were thus obtained in most cases, this process did not warrant anything like real safety and depended in an extraordinary degree on the skill of the men and the rapidity of working.

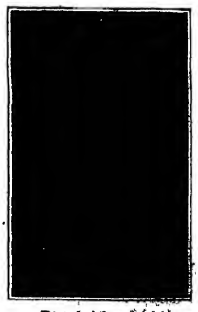
These unsatisfactory results are due on one hand to the physical properties of liquid air itself and on the other to the imperfect process used in preparing the explosives. Liquid air at ordinary atmospheric pressure, i. e., in the open air, of course possesses a temperature of —191 deg. Cent. (—311.8 deg. Fahr.) and liquid oxygen a temperature of —182 deg. Cent. (—295.6 deg. Fahr.), the temperature difference as compared with the surrounding rock thus being about 200 deg. Cent. (360 deg. Fahr.). It will thus be readily understood that a lively exchange of temperature by heat conduction and radiation should be set up between the explosive and its surroundings, the liquid air in the blast hole being vaporized most rapidly by the absorbed heat. In fact, the explosive cartridges used in connection with these early experiments were found to possess a maximum life of 10 minutes at the outside, their efficiency being considerably reduced even after a shorter life.

After being discontinued for many years, these experiments were recently taken up again by a German mining engineer, Mr. Kowastch, who in conjunction with Mr. Baldus of Charlottenburg, was allowed to work at the Royal Quarries of Rüdersdorf, near Berlin. In accordance with the above, Mr. Kowastch tried to prevent the liquid air in the blast hole from evaporating by any possibility beyond a given limit. He therefore conceived the idea of introducing the cartridge with the dry carbon holder separately into the blast hole without the liquid air, and afterward making any mining preparations (tamping the blast hole, etc.), waiting until the very last moment to add the liquid air and igniting the mixture immediately afterward. This process obviously allows the time of vaporization to be reduced to a minimum, thus saving much of the liquid air otherwise required, cheapening the process and warranting an incomparably higher safety.

A substantial pasteboard cylinder containing a perforated distribution tube and filled with an absolutely inert mixture of kieselguhr and oil, asphalt, soot, or paraffin, is introduced into the blast hole. Into the central distribution tube is introduced a thin supply tube (of paper) over which another paper tube for discharging any products of vaporization of the liquid air is slipped, after which the tamping can be safely proceeded with. Whenever several blast holes are to be fired simultaneously, the electrical conductors are properly connected with one another and with the igniting battery.

([illegible])

Ready to charge with liquid air.



The work of the explosive.

Liquid air blasting tests at Rüdersdorf quarries.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

BOOT LACE.—H W SHORT, 238 Seven Sisters road, London, England. The object here is to obviate the necessity of tying now in use, and to provide a neat finish for the lace. This is accomplished by use of a lace which in effect is endless and of approximately the exact length required only for engaging with all the hooks, the extremities of the lace being permanently connected together by means of a flexible and extensible spring coupling.

HAT PIN.—D. PERKINS, JR., Plano, Cal. The invention provides a pin with two telescopic tubular members, with means for holding these members yieldingly extended, so that a pin of a breastpin may be inserted in the members, which may be pressed together to permit the breastpin to be secured to the members as an ornament therefor A pin is secured to one of the members, and is of the length required to permit it to be used by women for securing the hat in place

CAP.—J TIM, 91 Mercer St., New York, N Y The object of the inventor is to provide a woman's cap of the knitted class, with the muffler as a part thereof, the construction and arrangement being such that the muffler may be secured in position around the neck or may be held secured on the cap when so desired.

Pertaining to Aviation.

AEROPLANE.—S N MALTERNER, Canton, N Y Mr Malterner's invention relates to aeroplanes, and comprises improved means for adjusting the angles of the main planes or lifting planes together, in the same direction or in opposite directions, as required by the various conditions that arise in actual practice

Of Interest to Farmers.

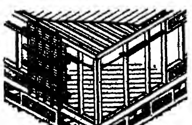
PLANTER FRAME.—A M CRISMAN, 242 Belle Ave., Davenport, Iowa. The invention provides a frame for seed boxes and furrow openers for planters of the type in Mr Crisman's patent No. 995,225, to insure that the furrow openers will follow a more uniform depth, and wherein the frame will maintain itself in a level steady position, and at the same time the furrow openers may be moved into and out of the ground in an easier and more expeditious manner

ATTACHMENT FOR MILK PAILS.—J A BLAIR, Steuben Township, Pa. This invention provides a device for holding a strainer in position across the open top of a milk pail. It provides an attachment for pails, of simple design, and make-up, which may be produced at a low cost.

Of General Interest.

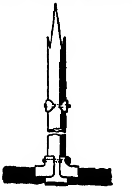
MEANS FOR PRODUCING A CORRECT WRITING HABIT.—MARGARET M. HUGHES, 78 Clinton Place, New York, N Y The purpose here is to provide a means for producing a correct writing habit in a comparatively short time and to teach a pupil the correct formation of the written letters of the alphabet, numerals, signs and other indicating characters pertaining to penmanship.

WALL CONSTRUCTION.—A F MEYER, 1001 Germania Life Bldg., St. Paul, Minn. Among the several important objects of this invention, is the provision of a wall construction designed to eliminate all planes of weakness and permeability resulting from the deposition of concrete in successive horizontal layers and to make possible and practicable the production of a pleasing and durable finish by means of brushing and washing the partially hardened concrete. Further, to provide a construction which embodies the assembling of a framework enclosing window openings and ordinary panels for the walls, the last being filled with concrete or other cast material, each panel being cast as an integral block.



WALL CONSTRUCTION

LIGHTNING ROD.—J. E. CURROW and R. E. [illegible], Lock Box X, Maryville, Mo. As is well known, the efficiency of a lightning conductor depends largely upon the amount of the [illegible] surface which is free, or out of [illegible] with any other; and the object of the [illegible] is to provide a rod having a maximum free surface and minimum weight. The inventors produce a cable that has great tensile strength, and large conducting surface.



LIGHTNING ROD.

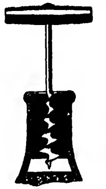
The engraving shows a side view of a portion of the cable or rod proper and a top of point secured thereto.

Hardware and Tools.

SHOVEL.—W S. KELLY care of Mary H Kelly 584 First Ave., So. Seattle, Wash Mr Kelly's invention has reference to a shovel particularly adapted for cleaning material from the floor of mills, and an object of his improvement is to provide a reinforced shovel having the maximum bracing affect for the least amount of material used.

CASTER.—J W HILFRANK care of N Y Orthopaedic Hospital, White Plains, N Y The invention relates to casters, such as are used on hollow legs of metal bedsteads and like articles, and it provides a caster arranged to permit of conveniently applying the caster to the terminal of the hollow leg and to insure the proper working of the caster when moving the bedstead or other articles about

CORK EXTRACTOR.—V HAINISCH via Bellosguardo 16 Trieste, Vienna Austria In removing corks from bottles with a screw like extractor it often happens that no portion of the cork is removed when the extractor is drawn out, except that held between convolutions of the screw The cork puller must then again be inserted which is done with difficulty, and the cork afterward removed, often in sections. Sometimes the upper half is removed by the corkscrew while the under remains in the neck. This is due to defect in the cork, and because the upper portion of the neck is often constructed so, that the lower portion of the cork offers greater resistance than the upper in removal. The inventor, as shown in the engraving, overcomes these difficulties by constructing the lower portion of the screw of a greater diameter than the upper



CORK EXTRACTOR.

Household Utilities.

SANITARY CLOSET.—J J GRAHAM, 116½ Florida Ave., Jacksonville, Fla. The present invention has reference to improvements in water closets, and particularly to closets arranged in an outhouse, and has for an object to provide an improved structure in which a vent pipe is provided and means for causing proper circulation of air

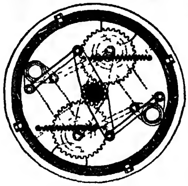
EXTENSION CURTAIN POLE.—J KNODEL, 107 E. 17th St., Manhattan, N Y., N Y This invention provides a pole, more especially designed for use between the jambs of doors or windows, and arranged to permit of conveniently placing the telescoping pole sections in position on supporting brackets and locking said pole sections on said brackets to prevent accidental disengagement.

Machines and Mechanical Devices.

BOOK COVER CLEANING MACHINE.—C. J RICE, Norwood, Mass. An object here is to provide means whereby the surplus gold or other filling substance may be rapidly and positively rubbed off the finished surface, and the device has for a further object, to provide means whereby gold or other material adhering to the rubbing tool may be brushed off the tool.

COTTON COMPRESS.—W HILL, Alexandria, La. The inventor provides a compress with means for moving one of the compressing members upon the article to be compressed at a relatively high rate of speed, and provides connections between the moving members of a compress to secure a relatively rapid rate of movement of one of the members and thereby diminish the time required to operate the compress.

TRANSMISSION DEVICE.—T H WILLIAMS, Buxton, Iowa. The improvement comprises a driving member and a driven member so connected that the driven member can be turned either in the same direction as the driving member or in the reverse direction, or caused to remain stationary without disconnecting any of the component parts of the transmission device which are used for imparting motion from one member to the other The speed when the driven member is turning in the same direction as the driving member, can be varied or adjusted to any extent.



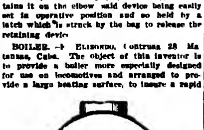
TRANSMISSION DEVICE.

Prime Movers and Their Accessories.

BEARING.—W J CHINNICK, Trenton N J This invention provides a bearing which can be applied to all the various purposes for which bearings are used which is strong, compact and light, and which can be rapidly adjusted by a simple manipulation to take up wear and to fit the bearing exactly to the member journaled therein

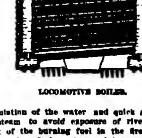
Railways and Their Accessories.

MAIL BAG CATCHER. F HANSEN, Woodbine, Iowa. This mail bag catcher of the hook or crane type is for use in connection with fast moving mail cars to take up mail bags from the station apparatus. One of the objects of the invention is the employment of a retaining device which is automatically tripped by the bag as it reaches the elbow of the hook, and thereby grips the bag and retains it on the elbow said device being easily set in operative position and so held by a latch which is struck by the bag to release the retaining device



MAIL BAG CATCHER.

BOILER.—F ELIZONDO, Contrusa 28 Matanzas, Cuba. The object of this inventor is to provide a boiler more especially designed for use on locomotives and arranged to provide a large heating surface, to insure a rapid circulation of the water and quick generation of steam to avoid exposure of rivets to the heat of the burning fuel in the fire box and thus reduce leakage to a minimum, to permit easy cleaning of the boiler, and to avoid incrustation.



LOCOMOTIVE BOILER.

CAR FENDER.—W T WATSON 616 Davie St., Vancouver, B. C. Canada This invention provides an attachment whereby the operating apron of a scoop fender is lifted from tripping contact with obstructions on the road bed other than accidental obstructions which it is intended should operate the fender and provides means for avoiding the operation of the scoop fender by inequalities of the road bed, or employment of a gate construction dangerously raised to avoid said inequalities.

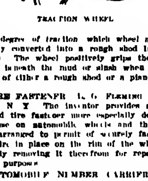
Pertaining to Vehicles.

HORN FOR MOTOR CARS MOTOR CYCLES AND CYCLES E TESTE, 18 Rue des Bois, Paris, France. The purpose here is to provide a hooter (such as is used on motor cars and other vehicles) capable of being caused to emit a number of different notes or sounds, and wherein the change from one note or sound to another is produced automatically by successive pressures on air bulb.

TIRE SUPPORT.—A HARRISBURGER, care of Frey Weiman & De Bruler Evansville, Ind. This support is for use on the side or rear end of an automobile for safely carrying one or more extra tires held on a demountable rim and arranged to permit of conveniently placing the tire and its rim in position on the support and carrying it safely along, and to allow of removing the tire whenever needed for replacing a wornout or burst tire

JUMP SEAT FOR GO-CARTS.—MARGARETTE M DANIELS 528 W Ellsworth St., Denver Colo. In this case the invention has reference to detachable front seats for go-carts, usually termed jump seats. The object of the invention is to provide a spring-supporting jump seat having novel means for securing it to the folding frame of the go-cart at the front

TRACTION WHEEL D H HUSTEN, Mantua, Ohio This improvement refers to a traction wheel particularly adapted for use on agricultural vehicles, and an object is to provide a plane band traction wheel having a high degree of traction which wheel may be readily converted into a rough shod traction wheel The wheel positively grips the solid earth beneath the mud or slush when in the form of either a rough shod or a plane band wheel



TRACTION WHEEL

TIRE FASTENER L G FLEMING Tarrytown N Y The inventor provides an improved tire fastener more especially designed for use on automobile wheels and the like and arranged to permit of securely fastening the tire in place on the rim of the wheel or quickly removing it therefrom for repairs or other purposes

AUTOMOBILE NUMBER CARRIER AND DROP.—G H HEWITT JR. care of Kern & Ward, 20 Broad St New York, N Y This invention facilitates the identification of automobiles and other motor vehicles in case they are involved in an accident or collision or during the confusion following a collision or accident when it often happens that the injured party or the bystanders neglect to note the license number of the car or fail to remember it accurately

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each Please state the name of the patentee, title of the invention and date of this paper

Price Maintenance and Modern Merchandising—I

Price Fixing by a Monopoly and Price Fixing by a Single Manufacturer

By Waldemar Kaempffert

[*THIS is the first of a series of short articles intended to set forth in a simple way the economic necessity of fixing and maintaining the retail price on certain kinds of manufactured products Merchandising methods have changed within the last twenty years—changed chiefly because nation-wide and world-wide selling has been made possible by advertising In this remarkable development of business economic discoveries have been made which are not yet widely known It is the purpose of these articles to set forth these discoveries so far as they affect price maintenance* —EDITOR.]

A single term is often used to designate two different acts or things, the one good and the other bad, with the result that it is sometimes difficult to distinguish them Politician has acquired a very sinister meaning in the United States yet in England a politician is a very respectable member of the community So the words price maintenance fixed prices, and their equivalents have come to mean, popularly trust control, whereas business men employ them also to designate a form of control that is far removed from monopolistic domination and that is in reality a healthy stimulus to competition

Between an agreement of twenty refiners to sell sugar only at 10 cents a pound and the policy of a single manufacturer to sell his trademarked or patented articles at a uniform retail price there is a world of difference The people must buy sugar at the price fixed by the combination of refiners assuming that they control the raw material for there is no other source of supply But the people need not buy the trademarked or patented breakfast food of the single manufacturer for there are a hundred other breakfast foods to be had if the price is too high It is curious that the term price maintenance should connote both a reprehensible and a commendable business practice

When a trust fixed prices before the Sherman law was effectively applied its chief consideration was public sentiment Would the newspapers print indignant editorials and satirical cartoons calculated to inflame the public mind? Would legislators be stirred into activity? These considerations were more important than a study of market conditions On the other hand the manufacturer who makes a particular brand of soap which he personally guarantees or a particular kind of watch to which he gives a name and reputation must study his market First of all he must gage the demand for his trademarked or patented product Next he must ascertain what competition he is likely to encounter The extent of his market and the number and character of his competitors very largely determine the price at which he can sell his product If he fixes his price too high he automatically cripples himself for he either limits his sales and thus his income or permits a rival to undersell him While the trust that controls a necessity of life may fix prices to suit itself unless restrained, a single manufacturer by the very stress of competition must set his price so low that the public will be induced to buy and that rivals will be unable to undersell at a substantial profit to themselves A trust may ignore the laws of supply and demand for a time a single manufacturer must obey them or fail

Pick up any popular magazine and glance through its advertising pages. You will find a half dozen more or less similar breakfast foods competing with one an other several watchmakers setting forth the merits of their timepieces, at least three large manufacturers of men s clothes who proclaim the attraction of their tailored fabrics and several fountain pen manufacturers who lay stress on the mechanical excellence of their inventions You will find that there is not a very wide variation in the prices of competing wares of the same quality Each manufacturer knows exactly that a retailer must make at least twenty to twenty five per cent profit on the advertised goods to do business at all and that the jobber who supplies the retailer must make at least fifteen to twenty per cent for the same reason He knows that he himself is entitled to about ten or fifteen per cent. Very carefully he studies his manufacturing processes his methods of buying material his system of distribution—all for the purpose of assuring to the jobber and the retailer the profit to which they are justly entitled and of allowing himself a profit large enough to place his business on a firm basis yet small enough to discourage competition

It is one thing to fix a price on a well known article of manufacture and another to maintain it Before the Supreme Court handed down its decision in the Sanatogen case it was comparatively easy to maintain a price on a patented article. The lower Federal courts have held that the exclusive right to vend his product given by law to the patentee meant the right to fix selling terms and the right to treat a price cutter as a patent infringer Since the Sherman law did not apply to patent wares the inventor stood in a very enviable position But the Sanatogen decision deprives him of his price fixing privilege and has placed him on exactly the same footing as the vendor of unpatented staple products

It matters little to a farmer whether the dealer to whom he sells his potatoes retails them at 10 cents or $1 00 a bushel but it matters a great deal to the patentee of a widely advertised watch whether his selling price is maintained or not. No one knows who planted the potatoes that the corner grocer sells but everyone knows who made the patented watch that sells for $50 The farmer spends no money in advertising his potatoes or distinguishing them from those of his neighbor He deals in a staple product. But the watch manufacturer spends perhaps a million dollars a year in coupling his name and honor with his watch in guaranteeing its workmanship in driving home its price His good name and reputation eventually become his principal asset in business They become a species of property of such value however intangible they be that they can actually be sold. If he loses his name and reputation either through his own carelessness or the trickery of others, he is in a poor way indeed

Good will and reputation mean far more now than they did in the past Before the days of systematic world wide advertising a craftsman and his handiwork were known chiefly in his own community A modern advertiser blazons his name and his pledges in a thousand magazines and newspapers. Millions know him by reputation and if his reputation is good he must inevitably prosper

One way of robbing a manufacturer of his good name is to offer his wares at less than the price that he has established by much expensive advertising If a fountain pen that is ordinarily sold at $5 with the minimum profit to the manufacturer and his distributors is advertised at less than the cost of production by some department store the public naturally leaps to the conclusion that the manufacturer has been too grasping in a word that he is not to be trusted Very few realize that widely advertised articles are thus sold at ridiculously low prices by department stores and mail order houses solely for the purpose of attracting custom, and that the loss sustained by price cutting is more than compensated for by an exorbitant profit on less-well known goods.

This policy of trading on the reputation of a well advertised article not only injures the manufacturer, but also the public. How that effect is produced will be explained in the next article of this series.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY You will find inquiries for certain classes of articles numbered in consecutive order If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information There is no charge for this service *In every case it is necessary to give the number of the inquiry* Where manufacturers do not respond promptly the inquiry may be repeated
MUNN & CO INC

Inquiry No. 9301 Wanted the names and addresses of a few concerns who can do machine embroidery according to the design furnished at reasonable rates

Inquiry No 9302 Wanted the address of the manufacturer of the Greenfield flexible armored conductors or cables. This is a double galvanized spiral conductor or cable.

Inquiry No 9303 Wanted the name of manufacturer who could make newly patented articles made from 18 to 28 gage sheet aluminum

Inquiry No. 9304 Wanted the names and addresses of manufacturers of a second hand bag cleaning machine on the order of a carpet cleaning machine

Inquiry No 9305 Wanted the name and address of concerns making paper letters and figures.

Inquiry No 9306 Wanted small hardware and other specialties to be sold in notion and grocery stores. Wanted to buy wholesale.

Inquiry No. 9307 Wanted to buy a machine for honing and stropping safety razor blades on a commercial scale

Inquiry No 9308 Wanted woven glass fabric for manufacturing purposes in large quantities. The glass is spun

Inquiry No 9309 Wanted to buy small woven tubing of small diameter for use over the temples of spectacles where they go around the ears

Inquiry No 9310. Wanted addresses of manufacturers of good selling articles for mail order business catering to the trade of [illegible].

Inquiry No. 9311. Wanted names and addresses of manufacturers of [illegible] beads made of colored glass also models of all shapes.

Inquiry No. 9312 Wanted to buy a machine which will pick up a weight the size of a [illegible] by vacuum system. Must be able to pick up [illegible] [illegible], etc. Must be operated by electricity and be easily portable.

Inquiry No. 9313 Wanted to buy Leather [illegible] [illegible] [illegible] [illegible] [illegible] In other words a Leather [illegible] [illegible] [illegible] at bottom—strapped over [illegible].

Inquiry No. 9314 This inquirer is in the market for some patented articles [illegible] [illegible] [illegible] with an investment of from $1,000 to $10,000. The name of the party will be [illegible] to any of our readers on application.

Inquiry No. 9315. Wanted the name and address of a [illegible] [illegible] [illegible].

Inquiry No. 9316. Wanted the names of [illegible] [illegible]

To the South Pole With the Cinematograph

(Concluded from page 561)

Of all the scenes cinematographed in the Antarctic that of Mount Erebus was the most difficult to secure. It would have been folly to drag the heavy apparatus up the volcano's side but by a stroke of good luck and through a special telescopic-lens taken especially to record the volcano a beautiful clear film was obtained

Once when I was securing a film of a pair of young skua gulls in their nest at very close range I was attacked by the parents so furiously that I was almost laid out One of the pair swooping down at me struck me such a blow in the eye with its wing that for an hour or two I suffered most acute pain and at first feared for the sight of my eye

On another occasion, when endeavoring to induce a seal weighing perhaps a half a ton to pose for a picture It suddenly evinced the most determined objections to the proceedings and lunging out at me it seized hold of my leg throwing me to the ground Its teeth went through all of my clothes and drew blood but I was not hurt owing to the fact that I fell Had I not done so, I think my leg would have been broken This, I believe is the only instance on record of a Weddell seal ever having bitten a man However I certainly invited the trouble and probably deserved what I got

The queer little penguin reminds one of a corpulent old gentleman dressed in immaculate white waistcoat with satiny top coat These birds are unable to fly their wings being merely flappers. Their habits greatly resemble primitive mankind in that the male selects his mate at certain periods of the year from among countless females who assemble on the hillside to be inspected by their future lords and masters. The little chaps saunter up and examine the maiden fair with no mean degree of intelligence and when they decide upon proposing the male sallies off and picks up a stone which he brings and deposits at the feet of her ladyship emblematic of his ability to provide a nest for their young She ignores him for some time until finally he has piled up quite a mound of stones and then quacks her approval and acceptance and off they go to establish a bungalow on the hillside

It is unnecessary to point out the tremendous broadening of interest which is afforded by the cinematograph in such an expedition as that of Capt Scott Time was when the results of these perilous voyages of discovery were scarcely thought worthy the cost. Nowadays however when the pioneer may train the eyes of all the world upon the windows which he is laying here for the first time by his efforts the risk is justified. He is not storing up experience for himself alone but for the whole of mankind. His success becomes a matter of paramount interest and importance to everybody because it is a success in whose benefits we can all now share

Mr Ponting when taxed with the question Did you learn the art of photography in your native land? replied No I learned most of my photography in one of the finest countries on earth—California I lived there ranching and mining for about ten years, and there is practically no branch of photography that I have not studied in that land of perpetual sunshine and flowers My work in Southern California attracted the attention of a big New York publishing house which made me an offer to travel around the world in their interests This offer was followed by others and since then (1909) I have been traveling and illustrating everywhere—in thirty different lands. These travels involved every possible kind of photographic work and in every conceivable climate I have had to take telephotographs of mountains 70 miles distant, and to go to the other extreme, micro-photographs of almost invisible objects. I have worked in the reeking, stifling jungles and swamps of [illegible], and on the plains of Manchuria, where the [illegible]

is so dry that the skin actually cracks. The most picturesque and altogether interesting section of the world that I have ever visited is the South Polar Continent."

Blasting With Liquid Air

(*Concluded from page 564.*)

The liquid air is kept ready for each blast hole in a special small flask containing a weighed quantity. These flasks carry at their opening a flexible metal tube with conical point into which the central supply tube is fitted. All that is required for charging then is to lift the back end of the flask, when the liquid air, under the pressure of its own products of vaporization (like mineral water under the pressure of carbonic acid) rises through the metal tube into the supply tube and through this into the cartridge entering there between the individual particles of the charge, ready at the very moment explosion is started by electric ignition to combine with the components of the cartridge in an explosion of terrific violence. The completion of the charge is readily ascertained by the cessation of the fizzing noise under which part of the liquid air escapes from the blast hole as a white fume

This process thus eliminates all the difficulties experienced in early attempts to use liquid air as an explosive Being readily prepared by a cheap process at the place of consumption, in fact, in the very gallery where it is to be used, it does away with the lamentable accidents inseparable from the transport and storing of dynamite above or below ground Furthermore there is no possibility of the explosive's being stolen, e g, for unlawful purposes, nor is the manufacture of the explosive itself connected with any danger, while the presence of considerable amounts of oxygen in the form of liquid air is a valuable addition to the salvage arrangements of the mine.

By using the cheap fuel available in coal mines, the operation of a liquefaction plant will be cheapened sufficiently for liquid air to compete successfully with the ordinary explosives.

A New Road Material

WITH a view of obtaining a road surface which will give a better resistance to automobile traffic, experiments are being made again in France with a roadbed material consisting of an intimate mixture of 'iron straw' or iron in the shape of a wiry or fibrous mass such as is commonly used for cleaning and scraping purposes in this country, together with cement mortar and sand. Such material is called "ferro-cement" and it appears that tests as to its fitness for road surfaces are giving good results. But the iron is not the usual kind found in commerce, but is prepared specially for the purpose by suitable machines of appropriate design It is claimed that the resulting material will not be an over expensive one

A Septuagenarian Arctic Explorer

IT is reported that Capt. Peter Bayne, who in 1868 was attached as a seaman to Capt. C F Hall's expedition in search of the remains of Sir John Franklin and his party, and who is probably the last survivor of that enterprise, has purchased the old arctic schooner 'Duxbury" at Seattle, and will head an expedition to Victoria Land, sailing next June. Capt. Bayne is 69 years old.

Coal in Nigeria

EXTENSIVE deposits of coal have been discovered at Udi, Southern Nigeria, and a survey is being made for a railway to connect this coal field with the river port of Onitsha. Analyses carried out at the Imperial Institute in London indicate that the Nigerian product has two thirds the value of the best Welsh coal. This discovery is likely to contribute much toward developing the resources of Nigeria.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents subscriptions books, etc. This will greatly facilitate answering your questions as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12815) R. A. M. asks: Can you tell me whether the moon revolves on its axis or not? A. The moon always presents the same side toward the earth and so does not rotate as we see it. But it revolves around the sun with the earth and in so doing presents every side to the sun each month. So the astronomers say that it turns on its axis once in a month. The sun rises and sets on each part of the moon once a month.

(12816) L. A. A. says: There is a controversy among a number of our villagers in regard to a ball after it leaves the gun, some claiming the ball after leaving the muzzle rises slightly from a dead level with the barrel, while others claim it begins to fall from the time it leaves the muzzle of the gun. Will you kindly settle the question? A. We would refer you to SCIENTIFIC AMERICAN Nos. 6 and 7 of vol. 107 for an article on the path of projectiles. If you have not these copies in your file we will forward them postpaid upon receipt of 20 cents. It is very possible that in particular instances there is a rise in the trajectory of a bullet above the line of fire. This is believed to be caused by what is termed unbalanced bullets. Despite the extreme care taken in casting the small lead bullets, the center of gravity of the bullet is often to one side of the axis. The twist of the bore causes the bullet to revolve about its axis. When the center of gravity of the bullet is off center, this twist causes it to revolve in a spiral. Upon leaving the bore, the bullet flies off at a tangent to the spiral. If the center of gravity of the bullet were to be at the upper side of the spiral at the instant it left the bore, it is very possible that the bullet would rise slightly above the line of fire. As stated above, this would hold true only in particular instances and is due to an eccentricity in the bullet rather than to a law of ballistics. If the lead bullet were perfect, it would be below the line of fire at all points on its trajectory.

(12817) J. H. M. asks: 1. I am making a chemical laboratory balance according to plans in your SUPPLEMENT, and I wish to graduate the beam into 40 divisions from center to end and wish to ask you what each division will read using a rider weighing 1, 2, 5 or 10 milligrammes? A. If you graduate the beam of your balance into 40 divisions each division will represent 1/40 of the weight of any rider you may use. We have never seen a balance beam divided in this way. They are always divided into 50 parts and the value of each division is then 1/50 of the rider, and if the rider is placed in the middle of a space between two divisions the value will be 1/100 of the weight of the rider. This is easily a metric division, but 1/40 will not be so easily calculated. The riders upon chemical balances and all the laboratory balances in common use have a weight of 10 milligrammes. One rider only is employed. This enables you to weigh 0.1 milligramme, and this is as far as you can go with an ordinary analytical process. The balance will not be sensitive to a smaller weight than that. It is not desirable to have weights less than the sensitiveness of the balance allows. Thus you cannot use gramme weights upon grocers' scales nor ounce weights upon hay scales. 2. Could denatured alcohol be used for making perfumes? A. If alcohol is denatured with wood alcohol, the odor will not be agreeable and will unfit it for use in perfumery.

(12818) J. T. asks: In your issue of May 10th, 1913, there appeared an article on benzol as a corrector of heavy oils for use in oil engines. Could we use an oil as heavy as a tar oil if we combined it with benzol, or would it need a special vaporizer to vaporize the oil? Or would it be more economical to mix benzol with our fuel oil? If so, where can it be obtained? A. You are doubtless quite familiar with benzol under its more common name benzine. It will dissolve and make more fluid most of the other and heavier oils which come off in the distillation of petroleum at a temperature higher than its boiling point. It can be obtained at almost every paint store, and gasoline does not differ much from it. Gasoline is often furnished when benzine is called for. Gasoline, naphtha and benzine differ in their boiling points. In distilling petroleum, that which comes off from 70 deg. to 90 deg. Cent. is gasoline; from 80 deg. to 120 deg. Cent., naphtha; from 120 deg. to 150 deg. Cent., benzine; from 150 deg. to 300 deg. Cent., kerosene.

(12819) F. H. P. asks: Please inform me through your columns of the numbers of the SCIENTIFIC AMERICAN or SUPPLEMENT in which I may find an explanation of the work of the spectroscope. I wish an extended discussion of this instrument and its various uses. A. We can send you twenty valuable papers upon the spectroscope and its uses for $2 and can send you our Supplement Catalogue, in which on pages 58 and 70 you will find a list of these articles. We would suggest also Young's "Sun," price $2, and Abney's "Sun," price $2.50. In both places indeed the subject receives full notice.

NEW BOOKS, ETC.

THE PRICE OF INEFFICIENCY. By Frank Koester. New York: The Sturgis & Walton Company, 1913. Price, $2 net.

Mr. Koester's book assumes rather a censorious attitude. Thus, statements such as that which occurs on page 12, to the effect that "no Catholic can become President of the United States, no Jew, no atheist, no Southerner and no philosopher, however great," finds its counterpart in similar assertions. We have a Southerner now in the presidential chair. But apart from a tendency to overstate his case, there can be no doubt that Mr. Koester has performed a really valuable service in pointing out wherein we are nationally inefficient and wherein we may improve ourselves. A thorough knowledge of German conditions enables him to present many an instructive contrast with corresponding American conditions, naturally much to our own disadvantage. Mr. Koester is a destructive rather than a constructive critic. He is better at picking out flaws in our social organism rather than at indicating how they may be eradicated. A very large part of the book is quoted matter, but it comes from excellent sources and helps along his cause.

THE PANAMA GUIDE. By John O. Collins. Mount Hope, Canal Zone: I. C. C. Press, 1912.

This is an excellent guide book written primarily for the tourist, but also highly instructive to the general reader who is seeking information in a compact form on the Panama Canal and its construction.

THE NEW HOUSEKEEPING. Efficiency Studies in Home Management. By Christine E. Frederick. Garden City and New York: Doubleday, Page & Co., 1913.

Mrs. Frederick's book is a republication of a series of articles that originally appeared in the *Ladies' Home Journal*. In it we find a very praiseworthy attempt to apply to housekeeping the efficiency principles of Mr. Harrington Emerson and Mr. Frederick W. Taylor. The thoroughly practical character of Mrs. Frederick's book, the intelligence which she displays in preventing wastes and in saving time and motion, make her advice extremely helpful even to the most experienced housekeeper. Now that the requirements of the housekeeper are thus lucidly set forth, it behooves the architect to profit by Mrs. Frederick's investigations; for at the root of all efficiency, whether it relates to a household or a manufactory, is a well-designed plant. Thus far the architect has provided a housekeeping plant which meets only the more obvious requirements—gas stoves, running water, ice-boxes and pantries. What is now needed is a house designed according to efficiency principles so far as its internal economy is concerned. In that work Mrs. Frederick's book will prove of great help.

LA MER. Fascicule 21 to 25. Paris: Librairie Larousse, 1913.

In these new installments of the excellent "La Mer" of Larousse we find popularly written yet accurate articles on yachting, handling a sailing ship, navigation, harbors and ports, the planning and administration of a port, maritime canals, etc. As a piece of printing and illustration this book of Larousse's may be regarded as a model.

WIRELESS TELEGRAPHY, WIRELESS TELEMECHANICS, AND WIRELESS TELEPHONY IN POPULAR PRESENTATION. By A. Monier. With a Preface by Prof. E. Branly. D. Dunod and E. Pinet. Paris, 1913. 242 pp. Price, 2 francs 50 centimes.

Wireless telegraphy owes a great deal to French scientific genius. We may easily forgive the author his patriotic pride, which induces him to claim for France the chief glory of the development of wireless telegraphy. Perhaps an impartial judge would be inclined to give chief credit in this matter to Maxwell and Hertz. The fact remains that the first practical detector for wireless waves, the so-called coherer, was devised by Branly. And the French are justly proud both of this and many other important contributions which they have made toward developing wireless telegraphy. The book before us is a most excellent popular presentation of the main facts relating to the theory and practice of wireless telegraphy. Of particular interest are the chapters on tele-mechanics, that is to say, the operation of various mechanical devices from a distance by the aid of electric waves. Very valuable too is the account of the wireless station installed upon the Eiffel tower. But the book is full of excellent material. There is a table of contents, but no index, a slight defect which may be excused in the case of so small a work, particularly as the table of contents is very complete.

DER BLUEHENDE SEE. Von Dr. Adolph Koelsch. Stuttgart: Kosmos Gesellschaft der Naturfreunde, 1913.

This is a well written popular account of fresh water flora. It is another desirable addition to the excellent, inexpensive and popularly worded monographs issued by the Kosmos Society.

WOMEN AS WORLD BUILDERS. Studies in Modern Feminism. By Floyd Dell. Chicago: Forbes & Co., 1913. 12mo., 104 pp. Price, 75 cents.

In spite of the author's protestations of sincerity, the motives and meanings he ascribes to the feminist movement are fantastic and overdrawn. This, however, does not prevent his narrative from being authentic and intense.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FATHER KNICKERBOCKER'S DAILY FARE.—[See page 579.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short and the facts authentic the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

Horse Living Versus Horse Power

IN the SCIENTIFIC AMERICAN of January 18th we published an illustration based on tables prepared by the Electrical Engineering Department of the Massachusetts Institute of Technology showing how far horse, gasoline and electric trucks of different capacities could travel per dollar. The expenses of the trucks were represented in the form of loads dragged along the ground behind them. In each case the load was made up of four different items, one representing the charge for feed, fuel or electricity, another for maintenance, the third for the garage or stable including driver and helper, and the fourth for overhead charges.

Where the horse showed to the greatest disadvantage as compared with the motor, was in the cost of feed. Herein is the principal difference between animal and mechanical powers. The reason is that the horse is using fuel constantly whereas the motor vehicle is using its supply of energy only when performing work. To put it differently, the horse is paid (in feed) by the day, while the motor is paid by the job (in gasoline or electricity). Work with a horse is a by-product. Most of the energy fed to it, is employed in building up and maintaining its own bodily health. If a horse required no food during its idle hours there would be little chance for the motor truck except in special conditions. To be sure a working horse is fed more than an idle horse, but it does not necessarily follow that the extra feed will all be converted into useful work.

It is very important to know just what return the horse is giving for the food it receives, because it eats fuel or fuel equivalent much more rapidly than the motor. On another page will be found an illustration based on figures furnished by the Massachusetts Institute of Technology showing how much work a horse does in an average working day, when engaged in the service of hauling freight from a railroad freight house to a dealers' warehouse. This is not necessarily typical of all lines of transportation but it does show that the actual work done by a horse may be far less than one would suppose without study. As depicted in our illustration, the horse truck was moving only 40 per cent of the working day. It was traveling between warehouse and freight house only 19 per cent of the day and during only 15 per cent of the day was there at least a partial load on the wagon. A working horse may be given as much as 33 per cent more oats than an idle horse in return for which it may be working only about an hour and a half out of a working day of ten hours, or only about 6 per cent of the entire twenty four hours, during all of which time it is consuming fuel for its own maintenance.

As it is principally in fuel consumption that the motor truck shows its superiority over the horse truck it is obvious that under conditions where actual work is done during only 15 per cent of the working day, the motor truck may show but little more efficiency than the horse truck. Obviously under such conditions the remedy is to adjust the work so that the truck will keep moving practically all the time with full load. This can be accomplished only by using special loading and unloading devices. A common practice is to provide separate bodies which may be loaded and unloaded at leisure without delaying the truck. Still another suggestion is to use trailers which may be coupled to the truck with a minimum of delay. The motor truck will then be the equivalent of a locomotive. In fact, Mr. Morgan Cilley, writing in a recent number of the *Engineering Record*, proved that in many situations a motor truck can do better work hauling trailers than carrying the same load on its own wheels. The motor vehicle is too valuable a machine to stand idle at any time during the working day. If the truck were used as a locomotive many problems of its construction would be eliminated. One of the principal difficulties met with in the ordinary truck lies in the provision of springs suitable for all conditions of traffic. If the springs are heavy enough for the fully loaded truck they will be stiff enough to rack the mechanism when the vehicle is running empty.

It may be thought that various time-saving expedients can also be applied to the horse. While there is no doubt that a better return for the investment can be made by reducing the idle time of the horse, it must be remembered also that it is when moving that the motor truck shows its chief superiority, and also that the horse cannot be kept working constantly all day long but requires many rest periods for recuperation.

A Simple Parcel Post Wanted

SINCE the enactment of the Parcel Post law of August 24th, 1912, and its introduction on January 1st, this year much criticism has been made in the public press about the complications, restrictions and unfairness of the Bourne eight zone system as specified in the law and a demand for a reduction of the number of zones, or instead, the establishment of a low flat rate with an increased weight limit, over the eleven-pound limit now in use.

According to a recent article in the New York *Sun* on 'Parcel Post Defects' wherein it refers to the evidence given before the Post Office Department Investigating Committee as being of considerable interest, it goes on to say

> When however responsible merchants declare in their evidence that their use of the parcel post has been reduced by nearly two thirds since its inception and that they have been compelled, however unwillingly to give their business back to the express companies it is obvious that something is seriously wrong '

The *Sun* refers to the carelessness in the handling of packages how in one instance half of the packages sent were received at their destination in a damaged (crushed) condition. It is also stated that in other countries where the system is in effect, damage to packages in transit is comparatively rare, and there appears no reason why a similar security should not be obtained here. It refers to the inconvenience of the special parcel post stamps and advocates a return to the ordinary letter stamp.

Referring to the zone system, the *Sun* continues

> 'A more serious difficulty is the zone system which is confusing and complicated. The enormous size of the country would seem to justify the system since it appears on the face of it anomalous to carry a parcel a thousand miles for the same price that is charged for five miles. Nevertheless, the shippers who gave evidence on Tuesday were unanimous in asking for a flat rate and in urging that the ideal system would be a bulk rate where shippers could drive a dray load of packages on the scales and pay at so much a pound or ton. If such a system were adopted it would probably be found in practice that the short freights balanced the long. Certainly it would make for simplicity, and if the public is to become habituated to using parcel post to the extent it should be used to justify itself, simplicity in its regulations is a first consideration '

The act of 1912 provides for the change of rates and weight limits and the consolidation of zones by the Postmaster General subject to the consent of the Interstate Commerce Commission when the cost of the service will not exceed the revenue therefrom.

If the plan mentioned above—"that the short freights balanced the long"—is true, and according to the law of averages it should be, it follows that a single low uniform parcel rate applicable for individual localities as well as great distances should produce sufficient revenue to be self-sustaining.

With the introduction of perfected high-powered automobile postal vehicles capable of carrying large volumes of postal matter direct from one post office to another, over night, between cities a hundred miles apart, much economy of transportation cost would be effected, and the expense of double handling be saved.

A similar use of the automobile rural delivery post wagon has been proposed by the Postal Progress League, where a vehicle should start at each end of the route, on a given hour, in opposite directions and carry merchandise and passengers by the parcel post system. This would facilitate the exchange of farm produce along the route and provide facilities at low rates to the residents on the route for personal transportation.

Postal personal transportation has been in successful use in a few foreign countries for some time. A simplified parcel post based on a single low, yet paying rate, will have a stimulating effect in the transportation of light commodities throughout the country, and encourage trading by mail to a greater degree than ever before.

The Aeroplane in War

ALTHOUGH aeroplanes were used on many occasions during the recent Turko-Balkan campaign, dirigibles were conspicuous by their absence, and there was no organized air-service which could give us any data on which to base any estimate of the value of aeroplanes, dirigibles, reconnaissance, or conflicts between the various types of flying machines, or the attack and defense of localities by way of the air. We must therefore hark back to the Turko-Italian campaign in Tripoli for actual war experiences, and although these were very one-sided, in that the Italians had three kinds of aircraft, dirigibles, aeroplanes and captive kite-balloons, whereas the Turks had none, the air service of the former was organised and worked systematically and achieved certain definite results on which we can begin to formulate opinions. On the whole, we gather that both aeroplanes and dirigibles were of great use to the Italians in the matter of reconnaissance. On rare occasions they assisted the artillery to find targets and regulate their fire, and they enabled the staff to correct existing maps by means of photographs, but with regard to dropping bombs the effects of the latter were decidedly moral rather than material.

In certain limited cases as regards inanimate objects of attack, aeroplanes might be effective, as for instance for the destruction of railway lines, since "sowing" a number of bombs, while the machine kept above a length of permanent way, would not be very difficult. As regards the destruction of fixed points, the aeroplane is practically useless, unless large numbers are used, each carrying one or two heavy bombs and coming comparatively close to the ground. Even so, the difficulties in obtaining accuracy of aim from the swiftly moving machine are very great. Besides this, the Italians found that even in face of the indifferent marksmanship of the Turks it was imperative to keep at an altitude of 4,500 feet in order to remain out of range of rifle fire. There is no cover in mid-air, and if the bomb-droppers should descend low enough to take any kind of aim, the attacking aeroplanes would have to run the gauntlet of a fusillade so heavy and sustained as to render sighting difficult and the chances of escape from destruction very slight. Ranging on aeroplanes has been shown to be extremely uncertain on account of their speed, and for other reasons, but the sustained fire of many rifles within say 1,800 feet and necessitating no special adjustment of sights would eliminate the process of range-taking. On the whole, the damage likely to be done by aeroplanes dropping bombs is negligible, the moral effect on good troops most uncertain, and not worth the expenditure of gallant lives and machines which are of much more value for purposes of reconnaissance.

Rail Inefficiency

IT has been said that there is no more efficient product of human industry than the steel rail, and this is probably true, but it is also true that there is hardly any element in industrial activity which is so inefficiently employed.

This fact will become apparent when it is considered that a rail is stressed almost to the limit of its endurance, under violent shock and heavy pressure, for a few minutes at a time, and then allowed to remain practically idle for several hours. With the exception of the rails used in and about terminals and yards, it appears that for a very considerable percentage of the time the entire roadbed of a railway system is idle, while for the balance of the time it is violently overworked. No modern manager would venture to work his men in such an irregular and erratic manner.

During the past decade the burden upon the rail has been greatly increased, both as regards engine and cars, and while attempts have been made to improve the rail, in form, weight, and constitution, the fact still remains that it is subjected to conditions far more severe and unequal than almost any other form of structural material.

Just where the remedy lies remains to be determined, but it would seem that before attempting to produce a stronger, or more costly rail, the desirable method of procedure would be to attempt to use the present rail in a more efficient manner. The real usefulness of the rail lies in its carrying capacity, in its effectiveness as a means of transport, and hence such reduction in maximum loads and increase in frequency of trains as would give maximum capacity with nearest approach to uniformity in burden, would apparently lead to maximum efficiency, and to such reduction in stresses as would render breakages extremely unlikely.

It is probable that such a modification in operation would, at first, fail to meet with the approval of traffic managers, as tending to increase the cost of operation; but when the limit of capacity is attained, as seems to be nearly the case, not only with the rail, but possibly with some other elements of the great transport problem, we may be permitted to inquire whether the inefficient use of the steel rail is not simply one among a number of indications that present railroad methods have almost reached that point of maximum capacity which indicates the necessity for radical changes in the entire treatment of the problem.

Electricity

Soldering Enameled Wire.—Now that enameled wire is coming extensively into use for winding electromagnets and for similar work, it is of interest to be able to solder the ends of such wire in a ready manner and especially to clean off the coat of enamel so as to leave the ends bare. Where the wire is very fine, it is a very difficult matter to strip the enamel without breaking the wire, so that the present German method is a timely one. The ends of the wire are dipped for some time in boiling potash lye or in concentrated sulphuric acid, or again in a concentrated and cold lye bath, then washed for an instant with hot water and dried by dipping in alcohol. This leaves a clean surface of metal for soldering

An Electric Ice-cream Freezer has been devised by a London inventor In the usual freezer tank, generally of large size for wholesale manufacture, hotels or the like, is mounted a tubular coil supplied from a carbonic-acid machine which takes the place of ice and salt. The small machine is mounted on a wall frame together with a small electric motor which drives it by belt from above, so that the outfit takes up very little floor space Cleanliness is secured by the entire absence of crushed ice and salt, and there are no wet floors. It is claimed that the electric device also gives considerable economy in working Another point is that where there are electric motors already in use for other purposes, the ice-cream machine can be driven from them without entailing the extra expense of a motor

Packing for Lamp Bulbs.—What is known as the "ovigarde" packing for electric lamp bulbs is proving quite a success in France It consists of an individual wrapping for each lamp which was at first devised for transportation of eggs, whence its name, and was afterward made in a suitable form for lamp bulbs It consists of an egg-shaped shell made of corrugated paper with the corrugations running parallel to the length of the lamp The envelope fits tight upon the lamp and is opened entirely down one side so that the wrapping can be opened out for inserting the lamp, then it folds over with an overlapping joint. At the top is a small narrowed part which surrounds and protects the pointed end of the bulb In this way the lamps can be simply packed in boxes like any kind of loose material without needing any further precautions.

An Electric Gas-analyzer has recently been produced which serves to give a series of rapid analyses of furnace gases so that the combustion may be observed Usually the amount of carbonic acid (or oxygen) is determined in this way An electric motor operates all the parts and the rapidly succeeding analyses are recorded on a paper drum in succession By raising a small water gasometer bell to a given height by the motor, a standard amount of the furnace gas is drawn in, then it goes into a potash absorption chamber where all the carbonic acid gas is absorbed. The remainder passes from here into a second gasometer whose bell is on the end of a lever, and the bell rises according to the amount of gas sent into it Should no gas be absorbed, the second gasometer receives the full 100 per cent of the standard amount, and the pen attached to it by a light arm now rises to the top or to the zero line and makes a dot by an electromagnetic device, showing no carbonic acid Were 30 per cent absorbed, it would rise less and indicate this latter amount Then the gas is evacuated and a fresh analysis made, and so on quite automatically, once in about every five minutes.

An Ocean Telephone—On May 1st what is probably the first ocean telephone call station was opened for public use This is in Platte Fougère lighthouse on a rock lying about 1¼ miles to the northeast of Guernsey, Channel Islands. The lighthouse, which has no keeper, is fitted with a powerful fog signal, worked from shore by means of a submarine cable. In a fog ships creep up guided by the fog horn and drop anchor near the lighthouse until the fog lifts sufficiently to enable them to take the narrow channel to the harbors of Guernsey In such case any pilot or ship's officer by climbing the lighthouse can ring up Guernsey telephone exchange and report his ship. The telephone is reached by climbing a 42-rung ladder to the platform outside the lighthouse doors. Before he can leave the ladder the pilot pushes open a trap door which covers the manhole in the platform. The arrangement is such that the pilot cannot open the lighthouse door to reach the telephone until he has shut down the trap door over the manhole. The act of opening the outer lighthouse door connects the telephone fitted outside the inner door of the lighthouse, which is kept locked. Only one wire in the cable is available for the telephone, and even this wire is required for other purposes, and closing the door after using the telephone connects up several tell-tale devices. The lighthouse door cannot be left open by forgetfulness, because the pilot must close it before he is able to lift the trap door in order to reach the ladder.

Science

Photographing the Aurora.—Prof Stormer and Dr. Birkeland spent the months of February and March at Bosekop, in northern Norway, making photographs of the aurora, continuing the remarkable work of two years ago As in the previous case, photographs have been taken simultaneously from two stations about 2½ miles apart, connected by telephone, in order to furnish means of computing the distance and altitude of the aurora.

Zigzag Lightning—Photography long ago proved that what was once taken for zigzag lightning is really sinuous, i e, without sharp angles. Otto Meissner, in *Das Wetter*, offers an explanation of the angular appearance of lightning He believes that the sudden glare of the flash causes an involuntary movement of the head or eye, the original image of the flash persists for a moment on the retina, along with the image produced on the eye in its new position Thus we get the impression of a broken line

Canadian Weather Forecasting is the subject of a useful brochure just published by the assistant director of the Dominion meteorological service, Mr B C Webber The writer is perfectly frank as to the unsatisfactory scientific side of weather prediction, and attempts to give only a digest of empirical knowledge pertaining to this work as carried on in Canada. It would be an excellent plan if the forecasters in all other countries would put the results of their practical experience on paper in the same way

A Superstition Concerning Mountain Sickness is reported by Mr W Bryce Douglas to prevail in Bolivia, viz, the belief that there is some connection between this affection and the presence of large mineral deposits in the mountains This belief is reflected in a Bolivian name for the disease—"veta"—meaning literally a lode or vein The natives thus attempt to explain the fact that the sickness is more or less local in its occurrence, and does not appear to depend solely upon altitude The pass of Livichuco, on the trail from Challapata to Sucre is known to contain large deposits of antimony, and is considered a bad place for "soroche" (mountain sickness), some travelers dying when crossing it

A New Variety of Bean adapted for dry climates was discovered under interesting circumstances by Prof R W Clothier, of the University of Arizona, as reported by him in a recent magazine article During a 1,300-mile wagon journey over the deserts and mountains of Arizona in the summer of 1908 he visited the Papago Indians, and obtained from them several hundred brownish-yellow beans of an unknown variety These were grown on experimental plots at the Arizona Experiment Station for four years before the discovery was announced It appears that the new bean, which has been named "teparv," is more prolific under dry conditions than any other known variety, yielding as high as 730 pounds to the acre with no water other than the scanty rainfall of Arizona Under the same conditions ordinary beans yield only from 60 to 144 pounds to the acre

Uses for Calcium Cyanamid—It is only a few years since it was discovered that nitrogen passed over hot calcium carbide formed a compound valuable as a fertilizer It is converted into ammonia in the soil and so can be used as a substitute for nitrates. More recent practice passes steam over the cyanamid and converts it into ammonia in the factory The catalytic action of cerium and thorium oxides on ammonia and air makes it possible to convert this into nitric acid, thus opening up a new market. Fusion of cyanamid with sodium salts converts it into cyanide, valuable in gold mining By treating cyanamid with water just below the boiling point dicyandiamid is made, a compound useful in the dye industry and in the making of explosives. In Germany they are selling under the names of "Ferrodur," "Intensit," "Hessolin" etc., materials for case-hardening steels. These powders are merely compounds of cyanamid with some alkaline salt and carbonaceous material

Taking Criminals' Finger Prints on the Spot.—Dr Heintl recommends a very good method for taking the finger prints of criminals, this not relating to finger-print records in an anthropometric bureau, but where the record is to be taken on the spot where a crime occurred such as on a wall or any object which cannot be moved and where the print is impossible to photograph on account of lighting or other reason He makes use of a very fine color powder so as to dust it over the prints which are of a more or less greasy nature, and in this way the powder adheres to the finger print and takes all its gradations. Then a specially prepared paper is pressed upon the print and the powder adheres to it so as to give a good copy of the original Such paper is prepared with a mixture of beeswax and paraffine adding a few drops of glycerine, coating the paper with a thin layer of the same The paper is of a very flexible kind so that it fits upon the surface of irregular objects It is said that a gelatine photographic paper has a good surface for taking off powder prints of this kind, and can be employed with success.

Automobile

A Pneumatic Anti-slip for Automobiles.—Patent No. 1,056,044 to Benjamin Douglass, Jr, of Orange, New Jersey, presents an automobile with an explosion engine, an ordinary muffler and a secondary muffler, which last is partly filled with sand and into which the exploded gases are discharged and subsequently silenced, and both mufflers are connected with the explosion engine and connections are provided from the secondary muffler to convey the silenced gases and some of the sand in front of and on either side of one or both of the driving wheels of the automobile so the force of the muffled gases can be used to spread sand to prevent slipping of the wheels.

The "Dog-fish" Body Is the Latest—We have had submarine bodies and aeroplane bodies, one designer has gone so far as to bring out a terra-marine body, and now comes the "dog-fish" body which is said to represent the very acme of perfection for touring service The "dog-fish" body is simply an ordinary touring body, or rather a torpedo body, in which the sides are extended to inclose the running boards, thus providing ample space for the storing of tool boxes, parts, etc The spare tires are accommodated in a bulbous back and the side door, giving entrance to the compartment over the step, is wide enough to pass a rather large trunk The horn and the lamps are quite invisible and when folded the top disappears into a compartment at the back of the body When in touring trim, the car is said to be waterproof

Automobile Omnibuses in France—The great extension of automobile omnibus lines throughout France for service in the country districts will be seen when it is observed that there are already 203 different omnibus lines running at present, a total distance of 5 350 miles The types of autobus or alpine car are supplied by 23 different works, most of which are in the nighborhood of Paris. The different lines which we mention are organized by 179 transportation companies When it is noticed that three or four years ago there were scarcely thirty of these autobus lines in operation, the progress made in a very recent period is striking Even now the matter is at the outset, and just lately the complex problems of operating services of this kind were but little known, leading thus to a hesitation on the part of the communes and the State to furnish subsidies Lack of co-operation among the companies was another drawback All this is now changed, and the forthcoming operating data are encouraging the authorities in the matter of subsidies, while the methods of the lines are becoming better established A general transport syndicate is lately organized a starting point having been made at the December 1912 Congress. From this time on, a brilliant future is predicted for automobile passenger service A few examples will show the kind of service in use, for instance the Nice Company operates 10 Berliet autobus in the Maritime Alps region from Nice to Briançon, a total of 170 miles The same enterprise operates a line from Avignon to Arles, 65 miles A line from Grasse to Castellane operated by the Touring Car enterprise, covers 50 miles with Peugeot and other cars The Auto Transport firm has 8 autobus running between Aix and Barcelonette, 105 miles Another enterprise has four lines radiating from Montpellier and using 9 De Dion cars, with a distance of 102 miles

Improvement in Motorcycle Magnetos—If the solution of ignition problems has done much to advance the automobile business it scarcely can have done less to advance the motorcycle industry Whereas it is a simple matter to carry almost any kind of ignition apparatus on an automobile, regardless of its complication or bulk, the equipment of motorcycles presents problems which are entirely foreign to any that can crop up in automobile work In the first place, it is absolutely essential that the ignition apparatus on a motorcycle occupy the smallest possible amount of space, for space is at a premium and the rider can ill afford to have his machine festooned with wiring and cluttered up with batteries and switches and what not And in the second place, it is even more important that the apparatus which produces the life-giving sparks be waterproof In these respects, it is interesting to note the really tiny size of the modern motorcycle magneto and the degree of waterproofness which has been obtained In the majority of cases the magneto is a miniature instrument practically built integral with the motor from which it is driven either by inclosed gearing or by a chain of the "silent" variety It forms a neat contrast to the bulky and weighty batteries and coils which only about a year ago were standard equipment on all but a very few machines and marks very plainly one very big step forward that motorcycle and magneto manufacturers have made within the past twelvemonth Also, these newer types of instruments are waterproof in the fullest sense of the word—a statement which could not have been applied with any degree of truth to their predecessors Without exaggeration, they will operate efficiently with a continuous stream of water playing on their "vitals" without the slightest apparent diminution of their spark-producing proclivities. "Bottling up" the internal economy of the instruments has not been an easy task, though it nevertheless has been thoroughly done.

Fig 1.—This example and that of Fig 2 are photographs obtained by interposing a sensitised plate between poles of an electrical machine

Lightning-Prints

A Curious Chapter in the Pathology of Lightning Stroke

By Charles Fitzhugh Talman

Fig 2.—This sensitized plate-print and that of Fig. 1 strongly resemble the typical lightning-print shown in Fig. 3.

IN the back of your mind there is probably the vague recollection of having heard that sometimes after a person has been struck by lightning the photographic image of a nearby tree or other object is found impressed upon the body. This is one of the ten thousand curious and neglected subjects that will be fully discussed in the as yet unwritten and unplanned Paralipomenon Encyclopedia—that anxiously awaited omnium gatherum of things left out of the conventional reference-books. The aggregate of the existing literature of the subject scattered through several languages is fairly extensive and the marks in question have occasionally been drawn and even photographed from nature. They are called lightning prints or keraunographs.

For our present purpose it will be convenient to distinguish two classes of lightning prints, viz. (1) arborescent forms popularly supposed to be photographs of trees or other vegetation and (2) a variety of other forms.

There is no doubt of the frequent occurrence on the bodies of persons who have been struck by lightning of ramifying marks strongly suggesting the appearance of trees, branches and the like. The accompanying Fig. 3 is drawn from a photograph of such marks on the arm of a boy struck by lightning near Duns, England, June 16th, 1883. The photograph was taken four and a half hours after the accident.[1] Some beautiful colored plates of similar marks (unfortunately too delicate for reproduction here) are given in S. Jellinek's Atlas der Elektropathologie (1909).

Formerly by many scientific men as to-day by the laity such marks were believed or at least conjectured to be the result of an actual photographic process on the part of the lightning. The following quotation from an interesting collection of lightning-print anecdotes published in *Chambers's Journal* for November 2nd, 1861, enshrines the old belief: "During a terrible storm at Lappion, France, six workmen and a child received severe shocks and a woman of forty-four years of age had the image of a tree trunk, branches and leaves distinctly printed in red upon her person." There appears no doubt that in all these cases of lightning prints the image produced upon the body indicates the object from which the electrical discharge emanated on its way to the person struck with lightning; in other terms, that the object whose image is produced formed part of the electric circuit. The same idea, though wrapped up in technical language, appears in more scientific discussions of the subject, including some of recent date. Camille Flammarion, in the first of his two anecdotal works on lightning,[2] devotes a chapter to lightning prints, in which he suggests the existence of "ceraunic rays" emitted by lightning and capable of photographing alike on the skin of human beings, lower animals and plants more or less distinct pictures of objects far and near.

Details of the recorded cases of lightning prints will be found in A. Poey's "Relation historique et théorie des images photo-électriques de la foudre" (Paris, 1861) (on which the above-mentioned article in *Chambers's Journal* is based); in three memoirs by J. C. M. F. Boudin (who introduced the term "kéraunographie" in this connection); in C. Tomlinson's article "On Lightning Figures," published in *Nature*, May 6th, 1875; in Flammarion's book just referred to; and in many other works. In by far the greater number of cases arborescent forms are said to have been produced. The marks were red or bright pink and generally disappeared in a day or two. In the original narrative it is nearly always assumed that the marks represent some particular tree or part of a tree, in the neighborhood, and it is frequently stated that this object was reproduced with absolute fidelity. It is hardly necessary to point out that, given the prevailing belief in the ability of lightning to produce such photographs, there is an excellent opportunity for self-deception as to the accuracy of the supposed delineations. This fact is well illustrated in one of the cases recorded by Flammarion. A man named Eliseon was struck by lightning at Pertuis, France, June 17th, 1896, and the newspapers reported that the image of a tree had been found upon his body. M. Flammarion corresponded with the surgeon who attended the case, a Dr. Tournatoire. The latter confirmed the newspaper report, stating that the image undoubtedly represented a poplar tree, standing a hundred meters from the place of the accident. Unfortunately for a good story, the doctor inclosed his own sketch of the lightning-print (Fig. 4). The outline is, to be sure, somewhat suggestive of a poplar tree, but only a mind strongly prepossessed with the belief that such marks are always photographs of nearby objects could have confidently identified it with the tree in question. In passing, it may be remarked that a very slight addition to the accompanying sketch would convert the "tree" into a "leaf." This is important in view of the fact that there are several cases on record in which lightning-prints have been identified as photographs of leaves.

In opposition to the popular belief there has always been a certain amount of skepticism on the part of the few scientific men who have interested themselves in this subject as to the photographic character of the prints. Prof. Pfaffe, in his article on lightning contributed to Gehler's Physikalisches Wörterbuch (new ed. 1825), seeks to identify these marks with Lichtenberg figures. A more plausible explanation, which must have occurred to many people before it was definitely suggested by W. Stricker in 1861,[3] was that these ramifying marks represent the ramifications of blood vessels, made visible by injection or extravasation under the effects of the electrical spark. However, this hypothesis was disproved by Rindfleisch,[4] who dissected the body of a man killed by lightning, and who found the arborescent prints did not coincide in the least with the position and direction of the blood vessels. To Rindfleisch we are indebted for what is, in all probability, the correct explanation, and it is a very simple one. According to this writer the ramified marks represent merely the lesions due to the passage through the tissues of a branching electric discharge. The heat generated by such a discharge against resistance accounts for the alteration of the tissues in this as in other cases of electrical injuries, and the branching of the spark is due to the different resistances encountered, as is true of ramified sparks in general (e. g. those seen in ordinary photographs of lightning in the open air). Further particulars on this subject will be found in the article on lightning injuries (by S. Jellinek) in the recent fourth edition of Eulenburg's Real-Encyklopädie der gesammten Heilkunde, vol. 3, p. 681 ff.

It will probably occur to physicists that the typical lightning print shown in Fig. 3 strongly resembles the photographs obtained by interposing a sensitised plate between the poles of an electrical machine (Figs. 1 and 2). Before leaving the subject of arborescent lightning prints it should be noted that these are sometimes produced on vegetable as well as animal tissues. An example is shown in Fig. 5.

Turning now to the second class of lightning-prints, we are confronted with a number of curious cases, some of which are certainly susceptible of an explanation analogous to that given for the arborescent forms, while others possibly are not. It is easy to believe that the electric spark might produce marks which the uncritical observer would identify as "photographs" of crosses, horseshoes, and other objects that happened to be in the vicinity. It may also be admitted that in many of the more marvelous cases reported the facts have been considerably embellished by the imagination of the narrators, just as happened in the case of the poplar tree mentioned above. We are inclined to apply this explanation to the following cases, [illegible]

Fig. 3.—Arborescent lightning-prints. Drawn from a photograph of such marks on the arm of a boy struck by lightning near Duns, England, in 1883. Photographed four and a half hours after accident. (From "The Lancet.")

Fig. 4.—An alleged lightning photograph of a neighboring poplar tree. (After Flammarion.)

Fig. 5.—Three pieces of the bark of a tree struck by lightning, showing lightning prints on their inner surface. (After Tomlinson.)

[1] Edinburgh Medical Journal, v. 29, pt. 1, 1883, p. 560-562.

[2] Les phénomènes de la foudre. Paris, 1905. Translated under the title "Thunder and Lightning" by Walter Mostyn, Boston, 1906.

[3] Virchow, Archiv, [illegible]

[4] Virchow, Archiv, [illegible]

Fixing the chemical purity of water for use in bottled goods.

Manufacturing Problems

A New Field for the Industrial Scientist

By F D Bell

Determining the specific gravity of syrup for bottling.

THE nature and uses of a factory product determine whether the manufactured article should be the result of combination of several raw materials to form chemical compounds possessing properties distinct from those of the raw materials as, for instance, in glass manufacture, or, whether the manufactured article is the result of partial chemical combination—as in rubber goods—or, finally, whether the particular manufactured product is the result of simple mixture, as in the case of many pharmaceutical and household articles.

In the case of chemical combination, various conditions materially affect the resultant product. The physical conditions, such as temperature and time of interaction, are frequently most important, but strength and purity are very essential. The manufacture of glass, while in all cases the result of combination of similar basic constituents, such as silica and the alkalies, may, by the addition of special ingredients, yield products having the most infinite variety of properties. In this manner window glass, plate glass, lamp globes, bottle glass, thermometer tubing, chemical glassware designed to resist the action of chemical solutions, gage glass designed to resist the action of hot water and sudden changes of temperature, various colored glasses, and a host of others, are the result of proper combination of ingredients which give the desired properties to the finished product.

The manufacturer of hydrogen peroxide has spared no effort in searching for a suitable preservative which will enhance the stability of his solutions. Of the greatest importance is the quality of the glass in which the product is bottled, since glass which is readily acted upon by aqueous solutions greatly accelerates the decomposition of hydrogen peroxide.

Alcoholic and aqueous liquids and bottled table waters frequently contain sediments which are the direct result of the action of these fluids on the glass container In some instances, the alkali of the dissolved glass neutralizes the acidity of liquids to the extent of causing secondary reactions to take place, and in this manner induces certain chemical changes to follow These changes result in seriously altered flavors and precipitates, which render the product unsalable.

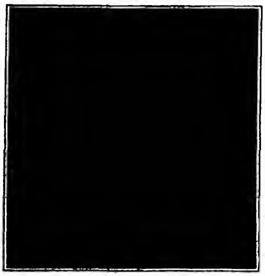
Bottled, non-alcoholic, drinks are subject to many other troubles than those due to the nature of the glass. In some known instances, which it is probably safe to assume are typical of conditions throughout the trade, these prepared drinks are made without any regard to the chemical principles involved, the chemical purity of the raw materials, or the methods employed in putting the ingredients together Water containing large amounts of lime and magnesia may, with certain fruit acids, cause the direct formation of an insoluble compound which appears as a sediment after the goods are marketed.

Certain grades of caramel coloring, commonly known as burnt sugar coloring, may under certain conditions contain by-products formed in its manufacture, which, when brought into contact with certain flavoring extracts, will cause very dense sediments to form within a short time after being put up. In such cases the bottled beverage may be only slightly opalescent when freshly put up, but after a number of days—sometimes weeks—may develop the dense precipitates. The manufacturer [illegible] always tell by the appearance of the [illegible] whether or not it is suitable, and his first [illegible] of trouble comes from some complaining customer. [illegible] of these raw materials would [illegible] these embarrass- [illegible] being incom- [illegible] entirely satis- [illegible] predetermine [illegible] to ascertain [illegible] experimented

beverages which are sweetened with cane sugar, and not otherwise preserved, require the most careful attention on the part of the manufacturer owing to the readiness with which weak solutions of cane sugar undergo fermentation. A product which is crystal clear when bottled will often in the course of several days, depending upon temperature, develop a cloudiness and

Centrifuge used for whirling out sediment found in bottled goods.

deposit a sediment of yeast cells. It is only with scrupulous care and cleanliness in the washing of bottles and in the compounding that difficulties of this nature can be overcome. A syrup which shows but slight evidence of undergoing fermentation will invariably impair the appearance of the finished beverage.



Plating microscopic organisms which cause spoilage in bottled goods.

Even ice manufactured from distilled water frequently contains sediments which appear in discolored patches throughout the cake. When such ice is melted in a clean vessel, a deposit is seen on the bottom. In most cases sediments of this character are produced by corrosion of the tanks in which the ice is formed.

Many other articles of commerce are subject to changes which result in the formation of sediments. In one instance a mouth wash contained, among other ingredients, boric acid and water extract of a bark rich in lime After being on the market for some time, a heavy sediment deposited in the bottles, which upon analysis was found to consist of calcium borate. In this case a natural constituent of one of the ingredients was incompatible with one of the other substances contained in the preparation. It was only necessary to eliminate the lime from the bark extract in order to correct the difficulty

It is therefore apparent that a great many commercial products are seriously affected in appearance by the formation of sediments from varying causes. Sometimes a sufficient quantity of the sediment may be obtained for chemical identification, but in many instances it is necessary to resort to micro-chemical methods The microscope is a most valuable adjunct to the study of problems of this nature

While certain rubber manufacturers compound their rubber goods under strict scientific supervision, there are many instances where such goods are still manufactured without regard to sound chemical principles In the first instance, raw materials are purchased according to the quality desired and at prices commensurate with quality secured, whereas, in the second instance, the purchasing agent takes a haphazard fling at the representations of the salesman and is particularly apt to choose the article which is lowest in price and seems to possess the necessary qualifications then if a batch of rubber happens to be ruined, the factory foreman is held responsible

The importance of compounding rubber with a view to securing a satisfactory article for a definite purpose is too rarely considered Naturally a composition intended for tires cannot be expected to resist steam and in the manifold applications of rubber goods it is necessary that the composition should be so controlled as to yield an article of a quality satisfactory for a given purpose

Many a rubber manufacturer has had goods returned as being worthless because the user found that they did not "stand up" under the conditions to which they were subjected He naturally assumes that the manufacturer has supplied him with an inferior article, whereas the real reason is that some chemical or physical change has resulted, owing to the manner in which the rubber was used. A concrete example that aptly illustrates this point is that of a rubber manufacturer who employed whiting in some hose that was to be used for conveying a slightly acid liquid. The acid attacked the whiting in a short time and left the hose pitted and unfit for further use

Compounds containing lead and zinc are frequently used in rubber goods, which, in some stage or other, come in contact with food products, and in the event of such foods being slightly acid, contamination with lead and zinc would most likely take place. Germany is considerably in advance of our own country in this respect, since a law which went into effect on October 1st, 1888, prohibits the use of rubber containing lead and zinc in nipples for babies' feeding bottles, teething rings and similar articles. Rubber containing lead is prohibited in rubber tubing used for conveying beer wine and vinegar Toys, with the exception of large balls, must not contain rubber compounded with lead.

Perplexing problems continually come up for solution in the manufacturing industries. As an example we might consider the case of hydrogen peroxide Everyone is familiar with the fact that the solution of hydrogen peroxide deteriorates on standing In order to enhance the keeping qualities, it is customary for the manufacturer to add a certain proportion of acetanilid. While it is known that hydrogen peroxide solutions containing acetanilid will develop unpleasant

odors on long standing, yet there are certain conditions which, if not properly considered, will result in un usually rapid development of such odors.

One manufacturer had his entire business threatened on account of a peculiar odor resembling iodoform, which developed in his hydrogen peroxide in less than a week after it was made. An investigation disclosed the conditions responsible for this peculiar phenomenon and no further difficulty was encountered, after proper changes in the process were instituted

Even to-day certain manufacturers fail to realize the economies which result from a proper utilization of their waste materials. In the manufacture of hydrogen peroxide barium sulphate (technically known as *blanc fixe*) is obtained as a by product One manufacturer allowed this product to run down the sewer, whereas he could have obtained over twenty dollars a ton if he had taken the trouble to press out the water and put it in barrels.

The manufacture of hydrogen peroxide is of a type which requires chemical supervision in order to produce a satisfactory product at a reasonable cost It is necessary to know the strength and the purity of the raw materials used and the yield of hydrogen peroxide obtained as well as the strength, purity and permanence of the finished product

Manufacturers of disinfectants, such as coal tar and cresylic acid dips, have gradually been impressed with the need of a scientific supervision of their products. While many of the larger factories engaged in this work are scientifically controlled, there are still many factories where 'rule of thumb" methods prevail The finished product in this instance is expected to be of a certain germicidal strength, and to accomplish this, the composition of the coal tar oils must be ascertained in order to obtain a uniform product. The manufacture itself must be so controlled as to yield a homogeneous mixture, which will give a proper emulsion on dilution with water Recently many of these manufacturers have been interested in increasing the germicidal power of their products, and this simply emphasizes the effect which bacteriological science has had in establishing the fact that the germicidal power of these products was greatly overestimated in the past This is true not only of the coal tar disinfectants, but of many other types as well, for instance, of such products as tooth pastes, mouth washes and similar articles used in the household

The object of chemical control is not to conduct chemical analyses simply in order that only the very purest materials may be used in technical manufacture There is a limit to the purity required of certain materials used in the industries and it is the chemist's duty to select these materials in accordance with a required standard and to see that these are economically purchased. Take, for instance, the case of abrasives used for polishing glass lenses. A certain abrasive is required which possesses the requisite degree of fineness, so that it will not scratch, and furthermore it must have a certain degree of hardness in order to secure the proper cutting qualities. Obviously, the idea is to have an unadulterated material which shows the desired mechanical efficiency One of the abrasives used for this purpose is rouge or red oxide of iron. This occurs in varying degrees of purity, but the price of rouge depends upon the mechanical treatment to which the producer must subject the material in order to secure the desired qualities. It then becomes the function of the chemist to advise the user in regard to the grade of material which would be satisfactory for his purposes and to further inform him as to whether the price at which it is offered to him is reasonable.

Many instances exist where the manufacturer never consults the chemist until he experiences difficulties. This is by no means unnatural, since the patient seldom consults the physician until illness forces him to seek medical advice However, we must not lose sight of the fact that human beings are somewhat capable of knowing when their physical condition is such as to require medical attention, while it is impossible for the uninformed manufacturer to foresee his difficulties until perhaps the consumer rejects the goods which have been delivered. The consumer's first impression is that an inferior or adulterated article has been supplied and it is sometimes exceedingly difficult for the manufacturer to restore the confidence of his customer The case of a lubricating grease manufacturer who regularly had complaints from his customers owing to the peculiar spots and discolorations which developed in the grease, is an example of how some manufacturers neglect to remedy imperfections in their processes until their business has become seriously affected.

In practically every industry where a chemist's services are vitally necessary, and where there is a failure to employ a chemist, one finds a lack of definite knowledge of the products manufactured, as well as an almost criminal lack of economy Some enterprising companies, posing as manufacturing chemists, reap a harvest from such firms through the sale of "specialties" claimed to possess certain properties. There are many instances where factory managers purchase products, which, while apparently giving the desired satisfaction, are nothing more than ordinary well known compounds sold under fanciful names. In one instance, a compound was offered to a grease manufacturer which was claimed to purify the tallow Chemical analysis demonstrated that the action of the chemical was simply that of neutralizing the fatty acids of the tallow

This same effect was accomplished in the process of the manufacture, so that the new "purifier" was entirely unnecessary There is absolutely no objection to the company which markets an article having distinct and desirable properties in any given line of manufacture and secrecy is rarely necessary when the product has real merit. In the purchase of "specialties" the factory manager would do well to seek the services of a chemist in establishing the true value of the product in question

As in the case of "household" articles such as polishes for metal and furniture, washing powders, cements, etc., there is likewise a tendency to develop 'novelties" for the benefit of investors. Many an investor has been ruinously interested in some new and remarkable "development of chemical science" There are many instances where investment in chemical processes is indeed lucrative, provided the particular process is based upon thorough scientific principles and a knowledge of commercial conditions, but the wise investor will rely upon the chemist's help and advice regarding new developments of chemistry, and not plunge into the unknown with his capital.

Maiden Voyage of the "Imperator"

Some Features of the First 900-foot Ship

By J Bernard Walker

THE "Imperator," the world's first 900-foot ship, was launched by the German Emperor on May 23rd, 1912, from the yard of the Vulcan Works, Hamburg By the time she floated on an even keel, the great ship displaced some 27,000 tons of water This was the greatest launching weight on record, and its significance will be realized when it is stated that the mere shell of the ship, as thus launched, weighed more, by 4,000 tons, than did the famous "Deutschland' of the same company, built in 1900, when she was completely equipped, with full coal bunkers and provisions, and carried a full passenger list. When the "Imperator" steamed to the westward on her maiden voyage she weighed, or displaced, much more than double her launching weight, for her displacement at maximum possible draught is not far from 60,000 tons.

The length on deck of the new Hamburg American liner, from the beak of the huge bronze eagle that projects from the stem, to the stern, is 919 feet, and if we neglect the eagle it is 900 feet The beam is over 98 feet, and the plated depth is 73 feet

If we count in the 'tank top," or inner bottom of the ship, and the deck that roofs in the topmost tier of rooms, such as the ballroom, winter garden, etc, the "Imperator" has no less than twelve decks—that is to say, she is a 12-story building afloat. Nor is the comparison misleading as a measure of the towering height of the ship, for the first thing that strikes the visitor on going aboard is the unusual height between decks, which in the case of several decks is from 11 to 12 feet Now 12 to 12½ feet is the average height between centers of floors in a modern New York skyscraper, so that were it not for the great length of these towering ocean liners, which tends to dwarf their height, we should realize that an "Imperator" is a veritable skyscraper of the sea

If the ship were to be placed in Broadway it would be necessary to cut 18 feet beyond the building line on each side of that thoroughfare for a length of four city blocks, and the roof of the topmost tier of staterooms and assembly halls would extend far above the roof line of the six and seven-story buildings erected in the pre-skyscraper period.

At the first sight of such a ship as the "Imperator" one fails to grasp its magnitude. This is due to the fact that every dimension of the huge structure is increased in its proper proportion. Thus, the 900 feet of length is offset by the great height of the superimposed decks, overtopped by the huge smokestacks, each 30 feet in its largest diameter It is only when one of the so-called monster ships of an earlier date is ranged alongside that the overpowering size of the ship of 1913 is realized.

Another scale of measurement that tells the story of size is to consider the dimensions of separate details of the ship. Thus, a single watertight bulkhead, amidships, weighs 60 tons. The shaft jacks or stays weigh 30 tons apiece. Each of the four propeller shafts is 1½ feet in diameter, and each of the four bronze propellers is 16 feet in diameter Each lowpressure turbine casing is 17 feet in diameter, and [illegible] feet long, and the rotors within them are fitted with 50,000 blades (the largest 2 feet long), and these weigh 140 tons. The rudder weighs 90 tons, and the stern-post and its jackshafts weigh 110 tons.

The motive power of the "Imperator" consists of four main turbines driving four shafts, steam for the turbines being supplied by water-tube boilers. These water-tube boilers are an innovation in big ocean-going liners. Shipbuilders for the merchant marine have hitherto clung tenaciously to the Scotch boiler—a fine type, it is true, and thoroughly reliable. They have failed, largely through conservatism, to follow the lead of the naval engineers, who many years ago discarded the Scotch for the later type. The Hamburg-American Company are to be commended for breaking away from a too long entrenched practice by adopting the more modern and effective type.

The safety of the "Imperator" is assured by a complete inner skin from the bow to the after end of the engine rooms. Forward of the boiler spaces this skin is worked from 4½ to 5 feet in from the outer shell. Throughout the length of the boiler spaces it consists of the inner wall of the longitudinal bunkers. The bulkheads extend to a height of not less than 20 feet above the waterline, throughout the central two thirds of the ship, toward the ends they are carried higher, the collision bulkhead extending to the upper deck. In their construction close attention was paid to the question of distortion, and all bulkheads are stiffened by heavy I beams and other shapes to withstand, without distortion or leakage, the pressures which would arise from maximum submersion of the ship due to underwater damage. Furthermore, to insure that the bulkheads were thoroughly watertight, each compartment was filled with water to maximum possible height, and all leaks that developed were closed by calking.

It is of interest to note that when the bunkers of the "Imperator" are filled she will carry some 9,000 tons of coal

The maximum speed of the ship, on trial, was 23 knots. She carries a reserve of boilers, and it is probable that with all of these going under full pressure the "Imperator" could do 23½ knots.

The Maiden Voyage.

On her maiden voyage the "Imperator" left Cuxhaven drawing thirty five feet and displacing about 58,000 tons. The test of the seagoing qualities of the ship commenced at once with a head sea and a wind of a strength of eight out of a possible maximum of twelve The writer, who was on board, was at once impressed with the remarkable steadiness and quietness of the world's latest and largest liner The wing propellers, which in quadruple-propeller turbine liners have been hitherto a source of troublesome vibration, are in this ship placed well away from the hull, with the result that they rotate in comparatively quiet water, and well away from the belt of water which is drawn along by the skin friction of the hull, and is now known to be a prolific cause of propeller vibration.

No effort was made to push the ship to its full speed. The speed varied from 20¼ to slightly over 22 knots, the lower average speed being due principally to delays due to fog and heavy head seas. Perhaps the most notable feature was the practically complete absence of rolling, or at least of such rolling as was perceptible to the senses. On two days there was a heavy beam sea, the wind on the second day blowing for several hours with about the strength of a whole gale. The ship, under the pressure of the strong wind on her lofty superstructure, assumed a slight angle of heel, moving parallel with the waves with a steadiness that was remarkable, even in so huge a vessel. This absence of rolling is one of the marked advantages of the largest vessels of the "Imperator" type. Rolling can become severe only when the period of roll of the ship coincides with the period of undulation of the waves. In the case of the "Imperator" the period of rolling was about twenty five seconds, whereas the period of the waves on the days in question was about thirteen to fifteen seconds. It is evident that the larger the ship, the greater will be the difference of periods and the less the tendency to roll. Rolling on a ship of this size is only possible when the wind is in a certain position on the quarter, in which the speed of the ship as it runs with the seas may bring the period of roll and the period of the passage of the waves into coincidence.

The great depth of the ship—her stiffness as I girder—was seen to good effect when she was driving into a heavy head sea. The movement of the expansion joints in the uppermost deck was only between a quarter and three eighths of an inch.

The Articles on Price Maintenance

IT has been found impossible to publish in this week's SCIENTIFIC AMERICAN the article on the attitude of the public to price maintenance of retail products, which was promised at the end of Mr. Waldemar Kaempffert's article in last week's issue. In the next issue, however, we hope to give space to this second installment.

Father Knickerbocker's Daily Fare

WHAT does the average New Yorker eat per day? This question is answered graphically in the illustration on our front page, which is based on estimates made by the New York State Food Investigating Commission last year The annual bill for food is given at $634,683,449. Assuming that this bill is paid by five million inhabitants, the daily cost of living in New York for the average individual is about 35 cents. The annual consumption of beef and other meat food products is 880,000,000 pounds per year, costing about $176,000,000, which amounts to about half a pound of meat per individual per day If the meat were all beef, it would take about 3,000 beeves to supply the daily demand. It would be impossible for us to show this number in our illustration. Accordingly, we have represented the figure by a single beef three thousand times as heavy as the ordinary beef. More money is spent for meat than for any other item in the food list. In this estimate of meat, poultry and fish are excluded. One hundred million pounds of poultry are consumed per year Or, if the poultry were all chicken, it would amount to between 54,000 and 55,000 chickens per day, while 150,000,000 pounds of fish are consumed per year, amounting per day to about 82,000 five-pound fish Next in importance is the canned goods, for which $150,000,000 is paid yearly The average New Yorker drinks a little less than a pint of milk per day, the total daily consumption being two million quarts and over It would take a milk bottle nearly one hundred feet high to hold this quantity of milk New York eats nine hundred million loaves of bread per year and as it is possible to make three hundred loaves of bread out of a single barrel of flour, the daily consumption of flour used in making the bread is a little over eight thousand barrels.

The following is the table prepared by the New York State Food Investigating Commission. Those who love to juggle with figures will find the table full of interesting possibilities.

Quantity and Value of Food Consumed Annually in New York City

1	Beef and other meat food products—880,000 000 pounds at 20 cents	$176 000 000
2.	Milk—800,000,000 quarts at 8 cents	64 000 000
3.	Butter—139 000 000 pounds at 35 cents	48,650 000
4	Eggs—150,501 630 dozen at 30 cents	45 150 489
5	Bread—900,000 000 loaves at 5 cents	45 000 000
6.	Sugar—400 000,000 pounds at 7 cents	28,000 000
7	Poultry,	20,000 000
8	Potatoes—750 000 000 pounds at 2 cents	15 000,000
9	Fish—150,000,000 pounds at 10 cents	15,000 000
10	Coffee—45,000,000 pounds at 25 cents	11 250 000
11	Other vegetables and fruit	5 000 000
12.	Cheese—28,956,000 pounds at 16 cents	4 632 960
13.	Tea—5,000,000 pounds at 40 cents	2,000 000
14.	Cereals	5 000 000
15	Canned goods	150 000,000
		$634 683 449

The Death of Ernst Ruhmer

ERNST RUHMER, whose name is well known to readers of the SCIENTIFIC AMERICAN as one of the most fertile and ingenious of German inventors, died on April 5th last at the early age of thirty five He was a son of an engineer and was educated principally in the technical high school of Charlottenburg, and the universities of Berlin and Giessen After a brief connection with a prominent firm of instrument makers, he established an electro-physical laboratory Among his inventions are an apparatus for determining the number of interruptions of fluid interrupters, an instrument for photographically recording and acoustically reproducing sound waves with the aid of a selenium cell, a multiple microphone, a selenium photometer, a device for determining and registering the intensity of daylight, an arc-light interrupter, a television apparatus, and a system of light telephony in which selenium cells and searchlights were experimentally used with great success.

London Chamber of Motor Experts.—To take up work that long has been suggested as worthy of careful consideration, there has been formed in London an organization styled the London Chamber of Motor Experts. The expressed purpose of the Chamber is to take under advisement such patents as inventors deem valuable and to pass on their value to the trade, work which should be easy and which should be productive of authoritative results considering the eminent men who form the association. Carrying the idea still further, the Chamber will undertake to find capital to produce and market devices which in its opinion are meritorious. Weekly meetings will be held when inventors will be permitted to offer their ideas for opinion, a small fee being charged for the service. If, in the opinion of the Chamber the invention gives promise and the inventor is desirous of placing it on the market, the Chamber will undertake the work, [illegible] rendering an estimate of cost to the inventor.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Lighting Buoys with Selenium Cells

To the Editor of the SCIENTIFIC AMERICAN

It has just come to my notice the letter of Mr A K Sloan in the June 7th issue of the magazine, on automatic lighting of light buoys by means of selenium cells, of which he suggests the use of the selenium cell to control the buoy

The controlling of buoys by the selenium cell is by no means new, as this has been manufactured by Ernst Ruhmer, and has been in operation on the Baltic Sea for many years This has been described in Mr William J Hammer's book on selenium, etc, and also in a recent article on selenium by Dr Hausmann in a recent issue of the SCIENTIFIC AMERICAN

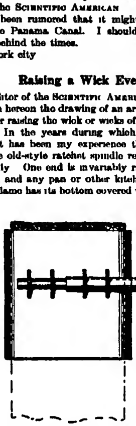
It has been rumored that it might be adopted for use in the Panama Canal. I should think that Mr Sloan is behind the times. SAMUEL WEIN

New York city

Raising a Wick Evenly

To the Editor of the SCIENTIFIC AMERICAN

I attach hereon the drawing of an arrangement I have devised for raising the wick or wicks of an oil cook-stove straight In the years during which I have used oil cookers, it has been my experience that after a short period the old-style ratchet spindle refuses to raise the wick evenly One end is invariably raised higher than the other, and any pan or other kitchen utensil placed over the flame has its bottom covered with an extremely oily soot



Device for raising a wick evenly.

To obviate this trouble I suggest the ratchet wheels be put on a double spindle, those near the front to be put on an outside or sleeve spindle, and the rear ratchet wheels being placed on a spindle running through the "sleeve" and extending the entire width of the wick tube. With this arrangement it is possible to raise one end of the wick independently of the other, thus adjusting the wick to give an even flame

REV ALAN PRESSLEY WILSON

1535 Edmondson Ave., Baltimore, Md

Price Maintenance and the Dealer

To the Editor of the SCIENTIFIC AMERICAN

We consider the action of some merchants (jobbers and retailers) in deliberately cutting the standard fixed prices on nationally distributed articles as absolutely unfair and unjust to the producers It requires a long time and the expenditure of a great deal of money to establish a national demand for any manufactured product And such demand can never be created or maintained except the product is of the highest merit

Instead of undermining the progress made by the producer through price cutting, the dealer should welcome an established, fixed selling price, alike to everyone, thereby assuring to himself a living margin of profit in handling such a product

I trust that through your campaign the public may come to view this proposition in its true and proper light. JOHN LUCAS & CO, INC,

ERNEST T TRIGG,

Vice-President and General Manager

Philadelphia, Pa.

Our Poor Maps

To the Editor of the SCIENTIFIC AMERICAN

What you have to say regarding map-making and publishing in this country is wofully true, and I have been swindled out of my money many times before I learned to look abroad for maps that are completely honest.

Because it is not so much the fact that his maps are decades out of date that marks the American map-publisher as lacking in enterprise and self-respect, but it is the unreasonable dishonesty of palming off old maps for new that puts large publishers in a class with fake fire-sale merchants

I have often paid several dollars for a map bearing a recent date, to find it lacking in ten years old information, to find that the old date had been scratched off the plate and a new date fraudulently inserted Think of such miserable tricks in the great and noble art of map-making!

As I am on a geographical subject, I wish to point out a hoary, seemingly deathless inaccuracy, which crops out in the article "Salving the 'Lutine'" The writer mentions The Barbadoes," whereas the correct name is "Barbados" pure and simple, being a single island of the West Indies, not a group of islands as many people seem to believe. MARION J FORT

Los Angeles, Cal

Controlling the Mississippi With Small Dams

To the Editor of the SCIENTIFIC AMERICAN

I have followed with great interest the articles which you have published concerning the recent floods in this section of the country In all of the above I have not read of a single plan that looks practical or feasible The method suggested to avoid future damage from great floods by building mighty dams and have great reservoirs impound the water does not seem wise or economical It would require the condemnation of immense tracts of land that are too valuable to be used simply for the storage of waste water Then too there would always be the danger of some of these dams bursting, and with the great amount of water back of them, would at various times do much damage in the valleys farther down And this is the very danger we want to avoid

As our civilization progresses, and our farm lands become more and more improved, tiling is done and the water rushed into the streams and rivers, with the resultant flood The National Government must interest itself in preserving the life and property of all the people, both up stream and down, and just how best to do this is one of the greatest conservation problems before it As the reservoir plan is unsafe and undesirable so, too, the suggestion that the country be reforested is untenable, it will never be done, it is too long a process, would require too great an outlay of public funds and use up lands that cannot be spared Then too, the project of widening all the streams will not solve the problem, as that will only aid in carrying off water from one place to make it worse in another

There is a plan however that will do the business, and at no great expense, that will not cause a lot of the best land to become mere swampy mosquito-breeding reservoirs This plan is to have the Federal Government rent or buy the flood lands along all the upper streams, runs, creeks and rivers, and at appropriate places build small dams with dikes and flood gates to hold back the water to a height of from five to ten feet These dams can be made at a very small outlay as compared to the large dams for permanent reservoirs.

Then, whenever there is a storm, let the gates be closed and catch the water in the basin thus formed until the dam overflows After a week or two, one after another of the gates can be opened and allow the water to drain off The holding back of the water in these small dams will cause a fertile deposit of sediment to be dropped on the flood land that will greatly improve it and not retard the farming interests in the least

A thousand such dams throughout Ohio during the recent floods would have saved many times their cost in life and treasure

The flood lands by this plan can be used every summer for raising crops, whether owned by the Government or individuals, and much of the poor, stony gravel patches found in bottom lands to-day, because of the rapid wash of streams, would disappear and become covered with the finest kind of soil

During the late flood the writer saw the rapid current of a stream—usually nearly a dry bed—wash away forty feet of the bank which had been under cultivation for years The great damage was done when water backed up by a railway bridge broke loose, and all came down the stream at one time This stream could easily have been controlled by dams as above described

By having small and numerous dams this danger of a great rush of water is remedied, for even if one or two should break down, it would have little effect, as there would be other reservoirs to catch and hold the surplus water

The writer claims for the small dams greater safety economy in construction and maintenance, increased value in abutting property, and consequent increased production for the State, and less chance for graft in their construction This last feature might be objectionable to many of the Government experts, but it is worthy of consideration nevertheless.

Fredericktown, Ohio. F A. DAY, Ph.D.

Melting Metal Under Water

By the Berlin Correspondent of the Scientific American

THE cutting of metals under water has entailed great difficulties and enormous cost, the tools and apparatus available for this purpose being utterly in adequate. Apart from the diver's hammer and chisel, compressed air chisels, and, for certain operations, circular saws driven from above, were used in this connection.

While the scope of circular saws is extremely limited, compressed air chisels are quite suitable in most cases, though, of course, the exceedingly high cost and slowness in operation are serious setbacks of this process.

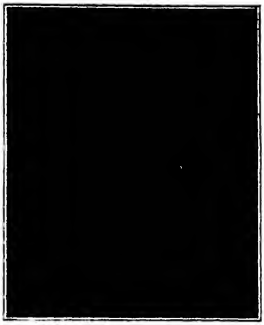
These conditions suggested the use of autogenous metal cutting for submarine work. As the hydrogen oxygen flame would be immediately extinguished, when immersed in water, the customary process could not be used. A German engineer, Mr. A. Heckt of Kiel, however, designed a bell-shaped burner head which being screwed on an ordinary Griesheim burner, allows the flame to continue burning below water, thanks to a supply of compressed air. This patented process has now been so improved by extensive experiments, that the cutting of metals under water is effected about as quickly as above the surface. In fact, the new tool is said to be ideal in every respect, avoiding as it does the drawbacks of the compressed air chisel while working extremely rapidly and accordingly most cheaply, and lending itself for use in the most varied applications.

The new process can be used in cutting through iron pile plankings and all sorts of iron structures, cutting up iron or steel wrecks or preparing them for blasting, clipping rivet heads, welding loose rivets, drilling holes, etc. The rate of working is at least twenty times as great as that of compressed air chisels, which accomplishment is bound to prove of immense value in clearing waterways of wrecks and other obstructions interfering with navigation.

At a test recently made of the new apparatus at Kiel harbor before some prominent engineers and representatives of the Emperor William Canal Department and several berthing companies, an iron plate of 100 by 20 millimeters in an exhibition tank fitted with glass walls, was bored and cut through about 10 centimeters in length by means of the oxygen hydrogen flame. A diver then went down into the sea, to about 5 meters depth and after boring a hole into a 60-millimeter square iron, cut through the iron in about 30 seconds. An iron sheet 20 millimeters in thickness was then drilled through and cut in 90 seconds, to above 30 centimeters' length.

hand to hand conflict, until so disabled it was necessary to abandon her.

The squadron was hardly completed when it was found that the British fleet was in waiting and ready to strike at any minute. The channel of Presque Isle Bay (leading from the bay into Lake Erie proper) was not very deep, and although the smaller vessels



Autogenous metal cutting tests in experimental and demonstration tank.

could readily get out of the harbor, it was with considerable difficulty that the "Lawrence" and the "Niagara" were moved over the sand bars in the channel. In fact, it was necessary to take off the armament and raise these vessels by means of pontoons placed on either side so that they would clear the channel.

The British fleet was in sight even during these operations, and consequently when Perry's squadron had hardly cleared port, the preparations for the battle were on in dead earnest—the actual fight occurring about one month later. After [illegible] maneuvering, the opposing fleets met on September 10th, 1813, at Put-in-Bay (in the Bass Islands), Lake Erie, where the memorable "Battle of Lake Erie" was fought.

The British fleet consisted of the brigs "Detroit" and "Queen Charlotte," corresponding in size and armament (although somewhat smaller) to the "Lawrence" and "Niagara;" the "Lady Prevost," similar to the American ship "Caledonia," and three small schooners—six in all. It is quite true, therefore, that the American vessels were not only more numerous (nine in all), but they were also more powerfully armed individually.

It would be needless for us to attempt to give the details of the battle, as this is fully and carefully described by many of our able historians. The facts remain, however, that the "Lawrence" was soon in the thick of the fight and borne down upon so heavily by the enemy that she was riddled and almost totally disabled. Perry consequently transferred himself and his few remaining officers and crew in an open boat to the "Niagara," then in command of Lieut. Elliott. The "Niagara" immediately became the flagship, and with her the battle was finished and the British squadron completely defeated.

After the battle, Perry sent his famous message to the Navy Department, which is quoted as often as Caesar's "Veni, Vidi, Vici," and which conveys much the same meaning, "We have met the enemy and they are ours."

There is just one more interesting feature which can hardly be omitted before giving the actual details of the raising of the "Niagara," and that is the controversy which arose between Lieut. Perry and Lieut. Elliott. It was claimed that the "Niagara" did not give the "Lawrence" proper support during the battle, and many assigned this as the cause for the "Lawrence" being literally cut to pieces so early in the fight. Perry himself preferred charges some years after the battle which would have resulted in the court martial of the "Niagara's" first commander, had not Perry died before the trial was to come off. Perry's officers and men stood by him, and Elliott's officers and crew stood by their superior all through the controversy. The result was that many an interesting street fight took place in Erie during the years following the battle, between the crews of the rival ships, and it is said that some of these "scraps" rivaled the famous battle itself.

Two years after the battle of Lake Erie—July, 1815—the "Lawrence" and the two British ships, "Detroit" and "Queen Charlotte," were ordered sunk by the Navy Department in Misery Bay (a small bay and a part of Presque Isle Bay, Erie, Pa.), while the "Niagara" was retained for some years as a receiving ship. The "Lawrence" was again raised in 1876 and sent in sections to Philadelphia for the Centennial there. The building in which she was housed during the exhibition, outside of the exhibition grounds, was destroyed by fire during the Centennial, and all that was left of the old battler was burned.

As the "Niagara" is really the ship on which our article hinges, we will therefore omit further details concerning the other vessels and confine ourselves only to this ship.

The "Niagara" was also given her final resting place in Misery Bay in the year of 1825 within a short distance from where the "Lawrence" lay. It was at the suggestion of Lieut. W. L. Morrison of the naval force of Pennsylvania that the Perry Centennial Committee first considered the advisability of raising the remains of the famous brig, and this was consequently begun in the fall of 1912. Contract for the raising was let and the work begun at once.

The old ship was covered completely with some six feet of sand and lay in about twenty-five feet of water. During the fall months a sand sucker was used to uncover the buried hull, and when this had been accomplished the actual raising was begun. Four heavy chains were forced under the body of the wreck in the following manner: Two pieces of [illegible]-inch pipe were joined at an angle and attached to a pump giving a hydraulic pressure of approximately [illegible] pounds per square inch. This pipe then formed a very powerful jet, which was [illegible]

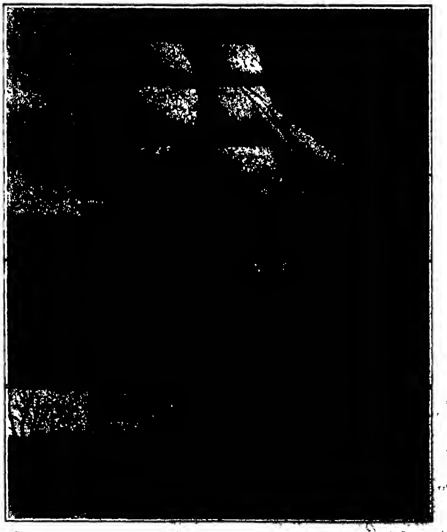
Raising the United States Brig "Niagara"

By W. L. Morrison and A. G. Kessler

THE Perry Centennial to be celebrated from July to September will be as memorable to history as the famous battle in commemoration of which it is to be held. Perhaps the most interesting feature of the Centennial will be the reconstructed brig "Niagara"—Perry's second flagship, which is now almost ready for launching.

Before going into the details of this interesting and historic work, it may be well to acquaint our readers of the important facts relating to the battle of Lake Erie. It is possible, of course, in this article, to give only the briefest outline of this memorable fight, and those who are interested, can secure further details from all of the standard books of American history on the War of 1812.

It was during the early summer of 1813 that Lieut. Oliver Hazard Perry, then a young man of twenty seven, succeeded against indescribable odds in building and getting together in Presque Isle Bay (Erie, Pa.) some nine ships, which number formed his entire squadron during the famous battle which was to follow. The two largest and most heavily armed vessels were the brigs 'Lawrence' and 'Niagara,' following these was a smaller ship, the 'Caledonia,' and six small schooners. The 'Lawrence' was chosen by Lieut. Perry as his flagship, and it was she that bore the brunt of what was practically a



The top picture represents the "Niagara" as she appeared in 1813. Below the pictures are views showing how sand and mud were blown away from the sunken hulk, how the wreck was raised, and how the hulk looked after having been lifted out of the water.

Raising Perry's flagship "Niagara."

An active dune covering brush land.

Sand Dunes

How They Are Reclaimed in Europe and in the United States

Reclaiming a sand dune by planting beach grass.

THE best example of the complete reclamation of shifting sand areas is in Gascony on the west coast of France. In the beginning of the nineteenth century this extensive plain was still a sandy desert, but to-day it is, through the work of the French Government, covered with a well-managed pine forest, which supports a large population. Large areas of the Coastal Plain of the United States are covered with enormous dunes, which continually move inland. These gigantic drifts of sand pile up high, covering fences, farm buildings and often vast stretches of valuable timber in their lee. In many places large farms are being buried underneath the sand. Along the Great Lakes entire orchards are smothered, railroads covered up, and extensive areas of arable land made desolate as a desert. Along the eastern coast of the United States from Cape Cod, Massachusetts, to Miami, Florida, hundreds of thousands of acres of barren sand hills greet the eye. Some are perched high on bluffs, others creep down to the water's edge. Years ago most of this stretch of sand land was covered with forests. Man removed the timber, fire after fire followed him, and the sand, which nature had expended centuries in reclaiming, was once more loosed and drifted about by the wind. Thus large areas in the United States are rapidly approaching the former condition of the Landes of Gascony, where 900,000 hectares of sandy moorlands were made productive by properly controlling the shifting sands along the seashore. The success of the work in Gascony has given assurance that similar results may be attained here, provided proper methods of planting are followed.

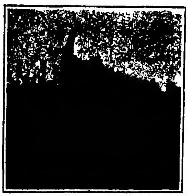
In France the fixation of these sandy barren wastes was started by constructing a littoral dune along the seashore. This dune was the secret of the success in the work. It was simply a bank of sand of certain dimensions, which served as an obstruction to the sand which came from the ocean. On top of this low bank of sand was erected a hurdle to check the sand in its forward movement and in this way the height of the littoral dune was increased. When the first hurdle was covered up another was put in its place, and still another until the dune was about 25 feet in height. This dune, which was about one to two hundred feet from high tide mark, protected the vegetation on the leeward side of the dune from the ocean winds and made conditions favorable for the growth of trees and other vegetation. The surface of the sand was covered with brush arranged like the shingles on the roof of a house. The brush was tied into bundles of about 10 inches in diameter and these were held in place by a few shovelfuls of sand here and there. The seed of beach grass (*Ammophila arenaria*) was then scattered among the brush and it soon sprouted and held the sand in check.

While this system was effective it had to yield to a newer, quicker, and cheaper method. The formation of the littoral dune is a very slow and expensive undertaking and it has been found that this step can be omitted by planting the windward side of existing dunes with beach grass or any other form of vegetation that can be made to grow in the particular locality. It has been conclusively proven [illegible] years of effort and almost endless [illegible] shifting sand cannot be successfully controlled by artificial barriers such as fences of boards (hurdles) or brush.

They serve to check the advance for a time, but later they are covered and rendered useless. Permanency of the sand can only be secured by a forest cover. The building of fences and covering the sand with brush, débris, or manure must be followed by planting or sowing grasses and setting shrubs and trees. Beach grass is able to withstand the action of the sand and wind, especially when it is planted sufficiently close together. If this method is followed the use of brush will be unnecessary. It has rhizomes many feet long by means of which it fixes the sand. The grass continues to grow and to develop new roots and increase in height as the dunes become higher. Wherever a patch of beach grass takes root there the sand blown from the region of greatest supply gathers around it. As the sand spreads, the grass grows through it until the hard, dry blades form the nucleus of thousands of tons of sand. The beach grass is the best among sand binding plants and is used extensively for this purpose. The chief characteristic of this plant is that when the sand tends to cover it up its height growth is stimulated in order to keep its tip above the sand. The home of beach grass is along the Atlantic Coast, but its artificial range has been considerably extended. It is now one of the principal sand binding plants in Europe and also on the Pacific Coast. Other grasses suitable for planting on the dunes are wild rye (*Elymus arenarius*), bitter grass (*Panicum amarum*), sea oats (*Uniola paniculata*), and bine-joint grass (*Calamagrostis sp.*). All these grasses possess special merit as sand binding plants, and can be used to advantage within their region of growth.

An ineffective method of controlling shifting sand along the Oregon Short Line (Columbia River), Washington.

The reclamation of the sand dunes along the Atlantic Coast has been suggested and advised, but only in a few locations have these plans been put into actual practice. It is possible to control these shifting dunes.



Lombardy poplar planted on a shifting dune at Manistee, Mich.

Cuttings of the poplar tree planted in rows of brush.

When nature reclaims a sand dune grasses are the first plants to make a start. These are followed by shrubs and later by trees. For a plant to live and thrive in shifting sand, it must have the power to grow upward as fast as the dune increases in height or to follow the sinking sand when it decreases in height. It must spread by means of underground stems, and must be a perennial. These conditions are met most successfully along the Atlantic Coast by beach grass. Certain shrubs meet the requirements for binding sand almost as well as some of the grasses. Among these are the native willows, wax myrtles, sand cherry and holly. Grasses are the first plants on the dunes in the natural process of reclamation and by means of these the movement of the sand can easily be stopped. After this is accomplished shrubs and trees should be planted. While the wax myrtle and sand cherry are good sand binders they do not produce useful wood. The willows and poplars are very valuable in reclaiming dunes and their woods have commercial value. The holly is very easily propagated and grows under adverse conditions. It forms an excellent shelter, and produces a clean white wood, which is used for a good many purposes and can be recommended for planting. The black locust grows in poor soils and is used in Europe for planting reclaimed areas. It also produces a valuable wood and the tree reproduces itself very freely, which is an important consideration in the management of the plantation. The pines indigenous to the region of the dunes are best suited. In New England the white and pitch pines will thrive on sand land after it is fixed. In New Jersey the pitch pine is well adapted and farther south the loblolly pine will make a good growth even on the exposed places.

An effective method of controlling a dune threatening railroad property

The Heavens in July

How the Navigator Lays Out His Course

By Henry Norris Russell, Ph D.

THESE words are written in the luxurious library of a modern Atlantic liner. Of the hundreds of passengers on board one may wonder how many have any realization that the speed and accuracy with which the great ship finds her way across the trackless ocean really depends entirely upon astronomical science.

Navigation—the science and art of determining a ship's position, and laying out her course—in its narrower sense is but the smaller part of the art of seamanship, but it is an essential part, and in itself, it is as much a branch of astronomy as of nautical learning. The mariners of early days never willingly ventured out of sight of land. In the days of the Phenician trade to England for tin their ships doubtless skirted the northern coast of France, far up the Channel until the chalk cliffs of England actually came to sight to the northward; then only did they dare to cross the narrow seas, and coast slowly along the British shores to their destination.

We need not cast any imputations on their courage for this: the lot of a ship blown off to sea out of sight of any landmark, in those days when there was neither chart nor compass, must have been almost desperate. Their only hope must have been of clear weather, so that they might lay a course with the aid of the sun or stars, in the general direction of the land, with hopes of finding some haven of refuge before their food and water gave out.

Things are indeed otherwise to-day: but why can the modern mariner sail out confidently into any sea, sure that he can tell where he is, even at the end of a long voyage, within a few miles at most, so long as he can but have a few clear glimpses of the sky? A few simple instruments, whose cost is the merest trifle compared with that of the smallest of seagoing vessels, make the difference. No sane man would put to sea without a compass, a sextant, a chronometer, and the *Nautical Almanac*, and these are all he needs.

At the risk of telling an old story to some readers, let us consider how these instruments are used to find a ship's place. What the captain wants to know are his latitude and longitude. To find the former is a very easy matter, but the determination of longitude at sea has been one of the great historic problems of applied science.

A moment's consideration will show why the second problem is more difficult. Latitude can be determined by observations at a single station, but we can find our longitude only by determining the time of day at our own position (which is easy) and the time at Greenwich at the same instant (which is a far harder thing to do).

The character of the observations which can be made at sea is strictly limited by the peculiar conditions. No fixed instrument can be used on a rolling deck, all measurements must be made with apparatus that can be held in the hand. This practically confines us to the use of the sextant, with which one sights on the sun and the sea horizon at one and the same time, makes the image of the sun seem to touch the horizon, and then reads off at once the number of degrees (and fractions of a degree) which the sun appears to be from the horizon—technically, its *altitude*. Any intelligent student, on land, or even in perfectly smooth water, can learn in an hour or two to make such observations with an error not exceeding a minute of arc (corresponding to one sea mile on the earth's surface). To get the same accuracy when the observer's footing can be maintained with difficulty on the deck of a vessel plunging in a high sea demands a degree of skill and dexterity for which those of moderate experience have the most lively respect.

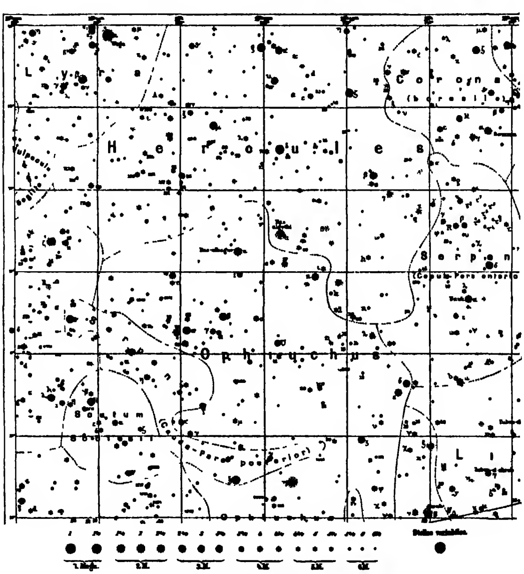
Granted, though, that we have learned how to find the sun's altitude (and, incidentally, to apply several necessary corrections to the crude observed value, and get an accurate result), what good does this do us?

Let us first consider our latitude. If we were on the earth's equator, the equator in the sky would pass right overhead, that is, its highest point would be 90 degrees from the horizon. If we were at the pole, the celestial equator would run all around the horizon—its altitude would everywhere be 0 degrees. It is easy to see that in other latitudes—for example, 20 degrees north of the earth's equator—our zenith (the point right overhead) would be 20 degrees north of the equator in the sky, and hence that the highest point of this equator would be 70 degrees from our horizon.

Now we cannot see the equator, but we can observe the sun—and the *Nautical Almanac* tells us just how far the sun is north or south of the equator every day, for example, to-day (June 2nd) it is 20 degrees 9 minutes north of the equator, so when the sun seems highest on the sky, the equator will be at just this distance below it (since our ship is in a northern latitude). If then, for example, the sun at its highest point in the sky, at noon, is found to be 63 degrees 37 minutes above the horizon, the celestial equator must be 41 degrees 28 minutes above the horizon. Subtracting this from 90 degrees, we find that our latitude is 48 degrees 32 minutes.

All this is very simple, and requires nothing but the sextant and the *Nautical Almanac*, for the greatest altitude of the sun can be found simply by making several measurements, beginning a little before noon, and taking the biggest one. To get our longitude we must do two things, find our local time and the Greenwich time at the same moment. The former is a matter of observation. If we know our latitude, it is an easy matter to calculate just at what interval before or after noon the sun will be at any assigned height above the horizon (less than its maximum). We have only to measure the altitude, and may then calculate the time by straightforward trigonometry. This observation should not be made near noon, for even the sun's altitude changes very slowly, and a very small error of observation will lead to a large error in the calculated time. By observing about 9 A. M. or 3 P. M., when the sun is rising or sinking rapidly, much more accurate results can be obtained. There is no great trouble about this, though it appears to the novice a much more difficult problem than the determination of latitude. With the aid of a table of logarithms and the *Nautical Almanac*, a practical worker can solve it in a few minutes. To be sure, he must know his latitude, but the captain always knows this with sufficient accuracy by means of his "dead reckoning" of the distance and direction which the ship has run since the last observation was made.

The real *crux* of the problem is to find what was the Greenwich time at which the observation was made. Nowadays it seems simple enough. Every ship carries at least one good chronometer keeping Greenwich time. The observer needs only to read the time by this chronometer at the moment when he measures the sun's altitude, and then, *if he knows how much his chronometer is fast or slow*, he has the Greenwich time. Then the difference between this and the ship's time gives him his longitude.



From Schurig's Atlas

THE HEAVENS IN THE REGION OF HERCULES

But to find the error of the chronometer is the real problem. At the present day a good instrument, carefully handled, is entirely satisfactory for voyages of two weeks' length or thereabout. Every day that the ship is in port, some officer will watch the fall of a time-ball, dropped just at noon by electrical connection with some observatory, and so find out the *error* of his chronometer (how much it is fast or slow) and also its rate (how much it is running fast or slow per day). But the "sea rate" of a chronometer may not be the same as the "shore rate," but a little faster or slower. When a ship has been out a month or more the chronometer may not be running at the same rate that it did in port, and a steadily increasing error will result. On long cruises, therefore, it is necessary to have some way of checking the chronometer. This used to be done by observing the moon—measuring its distance from some bright star. The *Nautical Almanac* gave in advance the calculated distances between the moon and certain selected stars for every three hours of Greenwich time, the change being about 1½ degrees in this interval. By comparing the observed distance with this, the Greenwich time at which the observation was made can be found, and hence the error of the ship's chronometer. But these observations are difficult to make, and very troublesome to reduce, as they involve long and tedious calculations; and they are now so rarely made that the *Nautical Almanacs* no longer publish the old tables of "lunar distances," but leave it to the occasional observer who

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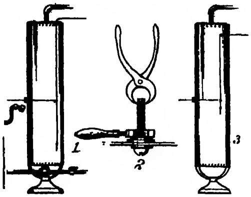
Some Suggestions for the Handy Man

By Henry Klots

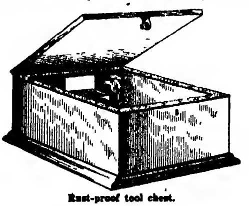
Repairing a Kitchen Boiler—A leaky kitchen boiler was recently repaired by the writer in the following manner First the water was drained off and then the holes were carefully enlarged by reaming them with the tang of a file until they were large enough to receive a small stove bolt easily The hot-water pipe was then disconnected from the boiler and bent slightly to one side, as indicated in Fig 1 of the accompanying drawing. A stout piece of thread, to the end of



Home repairs of a leaky kitchen boiler

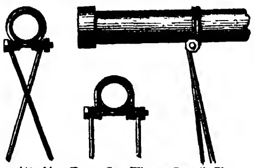
which a wire nail was secured as a weight, was then lowered through the hole in the top of the boiler By means of a wire hook the thread was caught and pulled through the pipe opening in the side of the boiler The wire nail was then disconnected and, instead a stove-bolt with a washer on it was tied to the thread and pulled carefully through the hole in the top of the boiler In this position it was held with a knife blade pressed against it until the thread was disconnected and a leather washer, metal washer and nut could be screwed down on the projecting end The bolt was long enough to permit of its being grasped with a pair of pliers and held firmly while it was being turned up with a wrench (as indicated in Fig. 2) The other hole in the boiler was in the side, near the top. Here the same method was pursued, except that a piece of wire with an eyelet at the end of it was used. Through this eyelet the thread was passed. The wire kept the thread away from the side of the boiler, so it could readily be hooked and brought through the opening for the hot water pipe After several days of use it was found that the water was leaking again, because the leather was rendered brittle by the heat. The work had to be done over again, but in place of leather, washers were made out of electric splicing tape or tire tape, bending a piece back and forth on itself six times and making a hole in the middle with two cross-cuts. In a similar way a long leak in the top of the boiler was mended by using a piece of brass with a washer of tire tape and fastening it in place with two bolts.

To Prevent Rusting of Tools—The writer found himself in Florida a few years ago where he experienced much trouble from rusting of his tools on account of the very humid climate The difficulty was overcome effectually as follows Along the top of the tool chest a strip of flannel was tacked, as shown


Rust-proof tool chest.

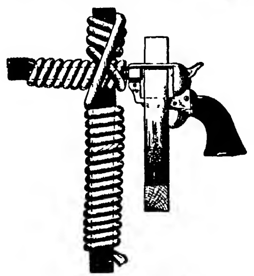
in the sketch, so that when the cover was fastened down it made the chest practically airtight. Then a large cigar box was procured and fastened inside the tool chest. The box was filled with unslaked lime. The cover was left on the cigar box, and always kept open except when the tool chest was moved about when, of course, it was closed to prevent spilling the lime.

Attaching Guy Wire to Smooth Pipe—Many wireless telegraph amateurs have experienced great difficulty in trying to attach the heavy guy wires firmly to the smooth galvanized iron pipe mast which is frequently employed as a support for the aerial wires. In order to preserve the full strength of the mast it is, of course, essential not to drill any holes or cut any slots in the pipe for the wires to fit into. The writer recently found himself up against the same problem, and solved it in the following manner: The guy wire was first wound three times around the end of an iron bolt near the head, then twice around the pipe, and then three


Attaching Heavy Guy Wire to Smooth Pipe.

times around the bolt again at the other end. The nut was then tightened up slightly so as to hold the wire in position while the other ends were anchored, and when this had been done it was screwed up tightly, and the projecting end of the bolt cut off

Removing a Revolver Barrel Without a Wrench—Recently the writer went on a hunting expedition to the Far West, in the heart of the Rockies, to a place over a hundred miles from the nearest railroad station Our guide had a revolver in which the barrel was worn out from much shooting, and as there were no gunsmiths handy, we sent to the factory for a new barrel and then without tools we proceeded to remove the old one and substitute the new one in the following simple and satisfactory manner A stout piece of rope was first procured, and one end of it securely tied with thread to the muzzle of the barrel The rope was next wound tightly around the barrel to its full length and then around a steel bar, as shown in the sketch A piece of square oak about 1½ feet long was next introduced into the frame, from which the cylinder had


An improvised pipe wrench

been removed, and then pressure was exerted on the steel bar and the oak stick in opposite directions, but without results, as the barrel was seemingly rusted in tightly The rope was then removed, the barrel heated and plenty of oil run around the thread where it screwed into the frame After this had been done and the barrel cooled down it was tried again, and this time it was unscrewed quite easily

The new barrel was then screwed into place as far as it would go by hand, and then wound with tape to protect the highly polished blued surface from being scratched The rope was then fastened and wound around as previously described, and then turned up tight into the frame. The revolver has had hundreds of shots fired from it since then, and found to be as satisfactory as though fixed up by an expert gunsmith

Some Automobile Repairs

By F C I

THE following are a few repairs made by the writer which may be found useful to the owner of an automobile If he does not wish to do the work himself he may hand the suggestion on to his repair man

Tightening a Loose Automobile Wheel.—In the older models of automobiles, many of which are still in use, the rear wheels are keyed to a straight axle. This gives rise to much trouble, for if the wheel once becomes loose, it soon works the key back and forth, wearing the key seat and shaft to such an extent, that it is almost impossible to tighten the wheels securely The best way of overcoming the difficulty is as follows The two halves of the axle are removed and the spindles (A, Fig. 1) are tapered in the lathe for the full length of the wheel hub, making them a quarter of an inch smaller in diameter at the outer end A bushing B is made to fit the wheel and is bored out to the same taper as the spindle, but is made about an eighth of an inch longer than the spindle. The old keyway in the spindle is then trued up and made deeper and a new key is fitted into it A slot is cut in the bushing on a shaper or with a hacksaw, which allows the bushing to be slipped upon the spindle with the key in place. The ends of the spindle are bored out and tapped to receive cap-screws G A washer F is made of the size of the hub tip, and with a hole for the screw G The bushing and wheel are slipped in place and the key is driven home The slit bushing is forced in and held in place securely by the washer F and screw G, while its tapered surface wedges the wheel securely to the spindle and keeps the wheel perfectly true The hub cap covers all If the bushing B is too short a split washer C may be added.

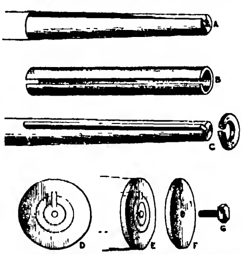


Fig 1—Method of tightening a loose automobile wheel

Lengthening a Valve Stem in a Motor—Valve clearance knocks are caused by too much space between the valve stem and its lifter, a sharp metallic knocking results as the lifter hits the stem, and also as the valve head hammers the valve seat on its return The valve lifter rises more slowly at first than later, hence the advantage of as little clearance as possible for besides allowing the lifter to come more gently in contact with the stem, the valve head is forced to move more slowly as it approaches its seat, hence it seats gently It will readily be seen that for quiet running, assuming the cams not to be worn and of the proper contour, this space should be reduced to the minimum. Too much space results often in loss of power The thickness of a visiting card is about right for some even a little less for others, depending on the expansion of the stem from the heat of the engine Some engines are not provided with means for adjusting this clearance An easy and entirely satisfactory method of reducing this space in such a case is as follows

An empty brass cartridge of almost if not quite the proper size to fit the valve stem is easily secured A punch is driven into the cartridge to flatten the closed end If the cartridge is a little too large and fits loosely, place it upon a hardwood peg and crimp it in three or four places with a chisel, as shown in Fig 2, or reduce it to proper size with a tap wrench

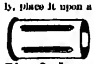


Fig. 2.—Improvised thimble for a valve stem

It can now be forced on the stem and will stay in place File off the end of the cartridge until there is sufficient space If this space closes when the cylinder gets hot file off just a little more The engine will tell you by refusing to go or stopping when the cylinder heats that more clearance is required The comparatively soft metal of the cartridge has a cushioning effect which also does much toward eliminating this unpleasant knocking

Emergency Repair for a Roller Bearing—Recently one of the spiral rollers in a Hyatt bushing in an automobile bearing was broken near one end and the piece caused trouble by becoming crossed, with the obvious danger of grinding and damaging the bearing No new bushing of proper size was at hand and the repair was made by inserting a small rod through the roller and riveting each end This temporary repair seems likely to prove permanent, as the owner of the car has never called for the new part which was ordered.

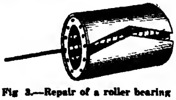


Fig 3.—Repair of a roller bearing

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Electric Batik Work

By Dr. Alfred Gradenwitz

BATIK work has been practised since time immemorial by the natives of Java, and consists of producing patterns by means of liquid wax on a bright fabric paper or the like, which is eventually dyed.

Electric Batik pencil in operation.

Such parts of the fabric as correspond to the pattern having been covered with hot liquid wax, the whole is dipped into a dye-stuff liquid, when the covered portions will take on no dye, whereas the remainder is dyed uniformly

Specimens of Batik work.

After drying, the same fabric (which is now multi colored) can again be covered with a pattern which, by the Batik process, is preserved in the former color, while the background takes a darker hue, and the same operation can be repeated several times until the back ground has become very dark

After removing the wax by washing the whole piece of fabric with gasoline, the various colors are brought out most effectively on the dark background. Wonder ful color effects are thus obtained, such as can be insured by no printing process, the fabric being permeated entirely with color, which is best appreciated on holding the fabric against the light

The possibilities of Batik work are by no means so limited as would appear at first sight The same process can, in fact be applied to wood stained in sev eral hues (or engraved), as well as to metal dyed or etched by chemicals. Especially beautiful etchings can thus be produced on copper brass, etc.

The instrument used by the Japanese in applying the wax is some sort of small funnel fixed to a handle with a fine opening in which the wax is heated over a coal fire Similar attachments, or else closed reservoirs terminating underneath in a point and a small opening are used in Europe where Batik work has been introduced. In connection with all these devices the wax must however be reheated from time to time (over an alcohol, gas or gasoline flame), and it cools rapidly during use This lack of uniformity in the temperature of the wax, of course, entails a number of drawbacks, while the liquid wax immediately after heating flows out in a very energetic jet liable to produce too thick lines or even blots, the outflow soon becoming very sparing, as the wax cools down. In order to insure an absolutely uniform temperature of the wax, a German lady, Frau Gertrud Lamprecht-Gewecke of Nuremberg, has devised an electrically heated Batik pencil Apart from uniformity in the thickness of lines, this insures a considerably more rapid work (the continual reheating being dispensed with) and far greater ease and accuracy

The electric Batik pencil is a cylindrical wax holder to the lower part of which is screwed a mouth-piece with a fine bore. A fine sieve placed in the wax holder above the mouth-piece will retain any impurities of the liquid wax

The wax is heated by the heating coil the lead of which passes through the handle, being connected in its interior with a flexible cord by means of which the Batik pencil can be joined up directly to a contact box for 110 or 120 volts (or through a series resistance to higher tensions) The Batik pencil can be used with continuous as well as alternate currents, its consumption being about the same as that of a small or medium-sized incandescent lamp.

An Iceberg Indicator

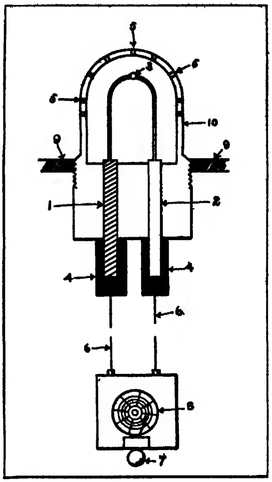
PROF HOWARD T BARNES of McGill University, Montreal, Canada, has blazed the way in the study of the detection of large bodies of ice through the read ing of the temperatures of the sea water at a distance from the source of chill. For this work Prof. Barnes has employed a microthermometer capable of registering variations of a thousandth of a degree Fahrenheit, and his researches have given to the subject a new significance.

Following the loss of the "Titanic," the United States Naval Authorities maintained for some time an ice patrol service in the mid Atlantic, two of our scout cruisers having been detailed to alternate on that duty Interest is now revived because of the Govern ment's intention to renew this ice patrol in the coming season of greatest danger These vessels can only maintain surveillance over a limited area, and there is every reason why each sea-going steamer traversing the North Atlantic should have its own means for certainly detecting the proximity of ice.

Many clever minds have given a good deal of study in the past months to the devising of instruments for this service, and certainly there is a need for some apparatus which can be relied upon, especially when approaching and passing through the waters south of Newfoundland, where confusion is engendered by the continual conflict between the Labrador current and the Gulf stream.

The prime desideratum is an instrument that will work at all times, one upon which the navigator can confidently depend.

With this latter and essentially practical aim in mind, Mr William H Bristol has worked out his detector, and the ingenious instrument promises to fill a want of long standing. The apparatus is fundamentally very simple, and its arrangement is such that its fitness for duty or its working order can be quickly determined at any time. The navigator cannot afford to trust to facilities which are uncertain in their functioning, and this has been the ruin of more than one cleverly-designed mechanism. The Bristol detector is based upon the well-known phenomena of the thermo-electric couple. For the sake of those that may have forgotten their school-day physics, let us explain briefly



1 and 2 are dissimilar metals forming the elements of a couple 3, the point where the elements join This is the active end of the couple, 4, 4, the insulated ends of the couple, 5, 5, openings to the sea, which may be closed if the couple be in touch with the metal envelope 10, 6, 6, the circuit connecting with the alarm system 7 and the recording mechanism 8, 9, the outside or bottom plating of a ship.

The thermopile, placed below water in contact with the sea, records changes of temperature.

Two half rings of dissimilar metals when joined together and either suddenly heated or chilled at one of these connecting points, give birth to a feeble current which will flow until the opposite juncture has acquired the same temperature. The sensitiveness and the potential of a thermo-electric couple depend upon the character of the two associated metals. The strength of this current can be increased by employing a number of couples, and a group of these bound for a single service is what is termed a thermopile. In order to get a sufficient electric impulse, Mr. Bristol uses a thermopile which is suitably placed below the waterline of a vessel and installed where it can feel quickly delicate differences of temperature in the outlying water. It is not necessary to expose the thermopile directly to the water; the desired effect may be obtained by having the exciting end of the thermopile in contact with the outside plating of the ship or with the thinner skin of a protecting envelope which is in touch with the sea.

Simple as this sounds, the proper [illegible] ments of the electric couples were found only after a great deal of [illegible] upon Mr. Bristol's part [illegible]

[illegible]

A, thermopile; B, mechanism operated by current from thermopile. This mechanism opens and closes the switches functioning the bells and lights C, D, E, and F; G, recording mechanism which shows the time and the character of the temperature change; H, the batteries of the operative relay; T, testing tank.

A device for detecting icebergs at sea.

Lightning Prints

(Concluded from page 578.)

British Meteorological Society by James B. Shaw in 1857. Six sheep were killed by lightning near the city of Bath in the year 1812. When the skins were taken from the animals, a facsimile of a portion of the surrounding scenery was visible on the inner surface of each skin. The pictures caused a great sensation when exhibited at Bath and Mr. Shaw, who was a school boy at the time of this occurrence states that he and his schoolfellows were so familiar with the place where the accident occurred that when the skins were shown to them they at once identified the local scenery so wonderfully represented. This story would be more impressive if the narrator had not been looking back through a vista of forty three years and to his boyhood days when he presented the facts to the world.

Another case which possibly admits of a different explanation is recorded in Casaubon's Adversaria published in 1610 and has often been quoted. The following version of the story is given by Flammarion.

On a summer's day about 1595 while divine service was in progress in the Cathedral at Wells, two or three thunder claps were heard of so terrible a nature that the whole congregation threw themselves down on the ground. Lightning occurred at the same instant, but no one was hurt. The astonishing thing about the affair lies in the fact that crosses were afterward found to have been imprinted upon the bodies of some of those present at the service. The Bishop of Wells assured the Bishop of Ely that his wife told him she had a cross thus imprinted upon her and that on his being incredulous she had shown it to him and that he himself found afterward that he too was thus adorned—on his arm if I remember right. Some had it on their breast, some on their shoulders. It is from the Bishop of Ely that I have these facts, which he tells me are well authenticated.

We have quoted this case because it appears to have led Dr. Carl du Prel[1] to suggest a totally different explanation of lightning prints from that proposed by Rindfleisch and one which though certainly not needed to account for the ordinary forms of the phenomenon might perhaps be invoked in the case just cited and a few others. According to Dr. du Prel the worshipers in Wells Cathedral were marked with crosses by a process analogous to stigmatization. He assumes that lightning struck a metal cross over the altar toward which the congregation was facing. This object brilliantly illuminated by the electric discharge, would in his opinion have furnished the dominant suggestion needed to accomplish the impression of a cruciform image upon the bodies of suitable subjects, i. e. persons susceptible to the ideoplastic process. We give this suggestion for what it is worth. It is certainly simpler to assume in the case in question that branches of the electrical spark actually struck some of the congregation even though they were not conscious of any shock and that the so-called crosses were merely intersecting marks produced by the discharge in the ordinary manner.

Raising of the U. S. Brig "Niagara"

(Concluded from page 580.)

placed in position at one side of the wreck and gradually forced under the old hull by means of the hydraulic pressure behind it. The sand and mud was blown away inch by inch and the pipe jet forced farther and farther under the wreck until ropes attached to the ends of this pipe jet could be fished up on the opposite side of the wreck and a heavy chain attached to these ropes drawn underneath the vessel. This difficult undertaking during these operations may be best [illegible] when it is stated that most of this work preparatory to raising was done through holes cut in the ice covering Misery Bay and during extreme weather conditions.

1 [illegible]

After the four chains—one forward, one aft and two amidships—had been placed around the sunken hull they were made fast to strong beams the beams being supported on pontoons on either side of the wreck. Strong levers some twenty to twenty five feet in length were then used in drawing up the chains link by link until the old Niagara was brought to the surface. This was accomplished without any damage or breakage of the hull and the wreck was then gradually shifted toward the shore. One of our illustrations shows a small part of the old battler as she appeared during the operation of moving her shoreward. She was finally beached and prepared as will be described later for rebuilding. What was left of the old ship may best be seen from the accompanying photograph taken shortly after beaching.

The hull was then set squarely into position and a proper bed and ways constructed. The lines of the vessel all of her principal dimensions etc. were then taken and transferred to a temporary mold loft. These lines and other data were transferred by the writers. They are wonderfully fair and sweet and show how advanced was the art of ship building a century ago.

The spar plan as nearly as could be obtained from all possible sources reveals many of the old forms of rigging used one hundred years ago.

The hull was found to have been constructed of various woods frames of white oak planking of 3 inch oak bulwarks of pine stanchions of red cedar and black walnut. The keel of 14 inch by 18 inch oak is wonderfully well preserved and will be used in its entirety in rebuilding. The keelson is 10-inch by 12 inch while the frames are 12 inches wide at the keel and have a center distance of 21¼ inches. The Niagara is 118 feet from stem to stern post, has a beam of 30 feet and a draft of approximately 8½ feet.

A very interesting feature is that every other frame is a natural knee giving the vessel wonderful strength and the ability to bear severe shocks and strains. Wooden pins (called "tree-nails") and hand hammered wrought iron spikes were used in the original construction. Our illustration shows the skeleton ready for rebuilding most of the old planking having by necessity been removed. The bow of the vessel is on the right hand of the photograph. The natural knees" previously mentioned are also shown and the general construction of ribs frames etc. The seams were found to have been calked with oakum and filled with tea lead, which is in itself a very interesting and unusual feature.

Another odd feature in construction shows that the steeler in the dead wood aft had been carved out of a single piece of wood instead of being made of separate planks.

The armament of the vessel consisted of eighteen 32-pound carronades and two long 12 pound guns the latter being used forward as bow chasers.

The total firing weight of the Niagara for her twenty guns was 600 pounds of shot and shell. How insignificant this seems when we realize that one of our modern 12-inch guns hurls no less than 850 pounds a distance of ten miles with deadly accuracy!

The rebuilding of the Niagara, true in every detail to the original ship, is progressing rapidly.

A fact of historic value is that the "Niagara" will probably be the last large wooden sailing vessel which will ever be built on the Great Lakes. She will be towed from port to port during the celebration, by the historic U. S. S. "Wolverine" (formerly the "Michigan"), which ship herself is over seventy years old and which has the distinction of being the oldest iron ship in the United States Navy. The "Wolverine" is now held in reserve and is used as the training ship for the Naval Force of Pennsylvania stationed at Erie, Pa.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Logging With a Motor Truck

MOTOR trucks occasionally invade the forests and bring out loads of timber but rough logging is a branch of the lumber industry in which little is heard of the motor truck While the logging locomotive is probably immune from any inroads upon its usefulness by gasoline trucks enough progress has been made in gasoline logging to promise a wide field of activity and warrant serious consideration of the power truck from the standpoint of what it has actually accomplished A five-ton motor logging truck was recently built for a man in Cleveland, who has had it in service for nearly a year in the woods near Brecksville in the southern part of Cuyahoga County, Ohio

On a small scale, this truck has done the work of the logging locomotive, the skidder and the donkey engine In addition it automatically loads the truck by its own power and then transfers its load from truck to flat car by that same power

While there can be no direct comparison between the work of this single truck and the enormous tonnage capacity of log trains, a careful analysis of the work of this truck bearing in mind that it is merely a single unit reveals interesting possibilities. It is built with a six-cylinder motor and in all other respects, except the wheels, it is of standard design The driving wheels are built of steel, with a twenty two-inch tread having the usual corrugated surface of tractor wheels, and enabling the truck to run over rough surfaces and soft ground such as will be encountered on any timber tract.

A power winch driven off the transmission of the truck, is built amidships and controlled by a lever similar to the brake and gear shifter Loads as high as six tons have been carried without difficulty, although the rated capacity of the truck is five tons. By proper use of the power winch and a simple scheme of rope and chain tackle the crews have loaded 1 000 feet of lumber on the truck in twenty minutes. Furthermore, its remarkable capacity for loading is availed of in many ways, notably in the salvage of fine specimens of hardwood, which frequently fall into ravines and cannot ordinarily be recovered except at prohibitive cost.

The customary haul of the truck is approximately five tons for an average distance of about six miles. On arrival at the railroad siding the rapidity with which the truck drops its load and pulls the logs upon freight cars by the use of its power drum and cable, produces a great saving of time and labor

The logs ordinarily are dropped on the ground and then rolled up on the cars. If no cars are available, the crew simply drops the load and returns to the woods, knowing that the loading operation can be done quickly by the truck when the cars are ready The truck therefore has no idle minutes.

The Log of a Horse Drawn Truck

THE Electrical Engineering Department of the Massachusetts Institute of Technology has published a leaflet known as "Research Bulletin No. 3," which contains some interesting observations on the daily work of the horse, showing how much of the time the truck must stand idle while it is being loaded and unloaded.

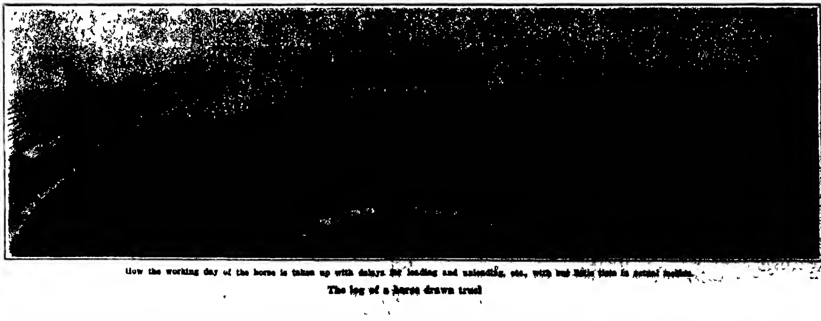
A six-ton motor logging truck taking on a load of lumber.

A study has been made of freight delivery in Boston Careful records were made of every movement of the vehicles from the time they left the stable in the morning until they returned at night. An analysis is published of the daily wagon performance based on eighteen days' observation of four different wagons handling miscellaneous freight. The average working day, or the time out of the stable, was 10.7 hours. It was found that 32 per cent of the day was spent at the railroad yards, 35 per cent of the day at warehouses, and the remainder of the day, or 43 per cent, on the street. Of this latter time, 13 per cent of the day was spent in traveling from and to the stable in the morning and the evening. The time spent in travel between warehouse and freight yards was 10 per cent of the day, during 15 per cent of which there was at least a partial load on the wagon To illustrate these figures clearly and show how much of the time the horse stands idle, we have prepared the accompanying drawing with the truck schedule laid out on a sun dial. Thirty-two per cent of 10 7 hours is 3.42 hours, or three hours and twenty five minutes. This was the time spent at the railroad station, and it was made up of nearly 12 per cent for loading, about 7 per cent for unloading, and about 5 per cent for delays of different kinds. The actual time moving at the railroad station was but 11 per cent of the day Not counting the time of travel to and from the stable, which as our dial shows amounted to 1 39 hours, or one hour and twenty-three minutes, only 3.21 working hours, or three hours and twelve minutes, were spent on the street, during two hours and two minutes of which the truck was in motion. One per cent of the day, or six minutes, the truck was delayed by congestion on the street. The remainder of the time, or one hour and four minutes, was taken up with meals and miscellaneous delays. At the warehouses we have the same delays. The time consumed in loading, 6 per cent, was thirty-nine minutes, unloading, 8 per cent, fifty-one minutes, while miscellaneous delays amount to 11 per cent, or one hour and ten minutes. Out of the whole day the motor truck was moving only four hours and sixteen minutes, leaving over six hours and a half in which the horse was doing no pulling, and only one hour and thirty-six minutes was spent in traveling between warehouse and freight yards with at least a partial load on the wagon.

To compete with the horse the motor truck can demonstrate its superior mobility not during the ten hours of the day, but only during four and a quarter hours of moving. It can get to work and return to its garage in quicker time, it can move about in the railroad yards and maneuver into position for loading and unloading in less time than is taken by the horse drawn truck, and it can move from the railroad yards to the warehouse in less time, provided there is not too much congestion on the street. But the time of loading and unloading at the railroad yards and at the warehouse and the time taken out for meals would be the same if the driver is to have his noon hour And so, although the motor truck may be much faster than the horse drawn vehicle, it can demonstrate its superiority only during a very small per cent of the day It is for this reason that so much attention is being paid to the loading and unloading of motor trucks at the present time, for the longer the hours of moving the greater will be the superiority of the motor truck. Dumping bodies are used for unloading the trucks, and special loaders, also separate bodies which may be removed for loading and unloading. Everything, in fact, is being done to avoid delays of all kinds, so that the motor truck can be on the street as much as possible, and spend most of its time in active competition with the horse.

Motor Trucks in Porto Rico

THAT Porto Rico presents an excellent opportunity for an extensive use of motor trucks is the assertion of Mortimer Remington, commercial agent of the United States for Porto Rico. The little island, with its population of more than a million, now stands eleventh in importance of the export markets of the United States. Its own export business has increased from a yearly total of $17,000,000 in 1901 to $92,000,000 for the fiscal year ending June 30th last, which speaks well for American occupancy The only railroad on the island skirts the shore, and as most of the products and produce come from the interior, an extensive system of highway transportation is essential. In the present system the ox cart is the principal transportation vehicle used. Motor trucks, however, have received a foot hold. There are now sixty-six on the island and their number is sure to increase rapidly Road conditions in Porto Rico favor the use of motor trucks. There are over 900 miles of stone roads, and the main highways are unsurpassed anywhere in the world. This accounts for the fact that there are now over 1,000 motor vehicles of all types there, and at the present rate of increase this number will be doubled in the next eighteen months.



How the working day of the horse is taken up with delays for loading and unloading, etc., with but little time in actual motion.

The log of a horse drawn truck

An Iceberg Indicator

(Concluded from page 586.)

are a safe guide only up to a point, and it was beyond this point that the inventor had to go in order to get a working unit which would meet responsively the temperature ranges to which it might be subjected in every-day service the year round and the world over

During his laboratory trials Mr Bristol s model apparatus gave a noticeable record f changes in heat of a fifth of one deg Fahr and this is practically about as refined a sensitiveness as would ordinarily be required By insulating the t-contact end of the thermopile it is possible to increase the working period. By adjusting the measure of this insulation a time lag can be fixed to suit the different speeds of the vessel so that a record will be made and an alarm given at definite intervals This apparatus is not a temperature-recording mechanism *per se* its prime purpose is to give warning of *sudden* variations involving the warmth of the sea water If the change is a temperature drop, the current flows in one direction and if a rise it circulates contrariwise The thermopile is wired to signaling and recording apparatus in the chart house One carries a smoked dial upon which a pointer traces a line that line marking the time and the sharpness of the temperature change The other apparatus is a combined visual and audible alarm The thermopile current is just strong enough to operate the recording point of one mechanism and the electric contacts of the other by which a relay of sufficient strength is called into service

If the impulse current is caused by chill a red light is illumined and a shrill bell sounded A green light glows and a low toned bell rings when the temperature rises The significance of these signals must be weighed agreeably to meteorological conditions, the locality and the season

H w does Mr Brist l make sure that the man on the bridge can know that the detector is on duty? A separate circuit leads down to the thermopile from the navigational station and near the active end of the couples a little resistance is placed in this circuit which heats quickly when the current flows. This heating is sufficient to affect the thermopile and in d ing this to give answering signals n deck When these signals fail then the detector is out of order This test can be made at any time and response is virtually instantaneous when all is right. The value of this will be readily appreciated by any practical seaman

The Heavens in July

(Concluded from page 588)

may have need of them to compute them himself from other data which are still given.

The method of the future, for correcting chronometers at sea will undoubtedly be by means of wireless telegraphy Signals are sent out at a specified time every day from the powerful station at the Eiffel Tower from the great German station at Norddeich, the American station at Arlington near Washington, D C In a few years it is hoped that, by international arrangement a network of signal stations may be established so that any ship on the seas may receive a daily time signal

The problem of finding the longitude will then at last be solved for good.

A century ago, when the art of watch making had by no means reached its present perfection, the best available chronometers could be trusted for only a few days, and lunar observations were necessary on voyages of any length. A little earlier even these were of little use, for the theory of the moon s motion had not been developed with sufficient accuracy to allow of good predictions of its position.

The Heavens.

We give again this month a detailed map of a portion of the [illegible] which is now well observable [illegible] south, in the early evening. This [illegible]

(Concluded on page [illegible])

INDEX.

The * Indicates that the Article is Illustrated with Engravings.

(Concluded from page 590.)

circle of Corona Borealis is near the northwest corner of our map, and the bright star Vega near the northeast corner. With these as guides the other stars may easily be found.

The telescopic observer will find much of interest in this region. In Corona Borealis ζ is a nearly equal pair, separable in a small telescope. β and δ Serpentes are also separable with moderate power.

In Hercules we may note the bright double stars δ (whose components are moving in different directions in the sky and have no real connection) α (a very fine pair, of strongly contrasted colors, the principal star being brilliantly red), and the fainter but easy doubles ρ Herculis, 95 Herculis (with contrasted colors) and μ Herculis, whose 9th magnitude companion, 30 seconds away, is itself double, but separable only with a powerful instrument.

The bright star ζ Herculis is an interesting binary with a period of 35 years but the components are unequal and little more than 1 second apart, so that a telescope of at least six inches aperture will be required to show them well.

About 5 degrees north of this—two thirds of the way to η Herculis—the map shows a faint object, which is visible even to the naked eye, and appears in a field-glass as a hazy round object. This is a great globular star-cluster, the finest in the northern sky, containing many thousands of stars. The view of this object which can be obtained with a small telescope falls far short of the magnificence of the photographs secured with large instruments, but it is nevertheless well worth looking at.

Farther south and east θ Serpentes is a fine wide double, within the reach of a strong field glass, and 70 Ophiuchus (almost exactly in 18 h R. A.) is a remarkable binary, now resolvable with three-inch aperture or less. Lyra, in the northwestern corner of the map, is full of interesting things. Vega, one of the whitest stars in the northern sky, has a faint companion of the tenth magnitude, which does not share in its proper motion, and is probably immeasurably more remote.

β Lyrae is a very remarkable variable, composed of two very large stars of small density, which revolve about one another almost in contact in a period of about 13 days and materially eclipse one another. The neighboring star γ Lyrae affords an excellent standard of comparison, since the variable is almost equal to it at maximum, and less than half as bright at minimum.

ζ and δ Lyrae are wide pairs, resolvable by a field glass. Still more interesting is the famous "double-double" star Epsilon (ε) Lyrae, just northeast of Vega. The smallest optical power will split this into two, in fact, the two stars, which are 207 seconds apart can be seen separated by keen eyes without instrumental aid. With a three-inch telescope, each component is found to be double.

The Planets.

Mercury is evening star throughout July and is best visible in the early part of the month, setting about 8 50 P M.

Venus is morning star in Taurus, rising about 2 A M. She is at her greatest western elongation on the 3rd, and appears in the telescope as a half moon.

Mars is a morning star, too, about 20 degrees west of Venus, but is far less conspicuous. Jupiter is in opposition on the 5th, and is in sight all night, though very far south for observation in our latitude.

Saturn is morning star in Taurus, and is in conjunction with Venus on the 21st, being 1 degree 18 minutes north of her.

Uranus is in opposition on the 29th. He is then in Capricornus.

Neptune is in conjunction with the sun on the 18th, and is quite invisible.

The moon is new at midnight on the 3rd, in her first quarter at 5 P. M. on the 10th, full at 1 A. M. on the 18th, and in her last quarter at 5 A. M. on the 26th. She is nearest the earth on the 6th, and farthest off on the 22nd.